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STATUS, PROSPECTS OF BELORUSSIAN PEAT INDUSTRY SUMMARIZED

Moscow TORFYANAYA PROMYSHLENNOST' in Russian No 1 Jan 83 pp 2-6

[Article by Minister G. A. Filippov: "Belorussian SSR Peat Industry on the 60th Anniversary of the USSR's Formation"]

[Excerpts] Owing to scientific-technical progress, during the years of Soviet rule fuel industry transformed into a highly productive, fully mechanized sector providing for the continually growing demand of the national economy and the public for fuel, including peat briquettes, for municipal and personal uses.

During the first five-year plans the republic built its first peat-digging enterprises--Osintorf, "Put' Sotsializma" and others, which became the main suppliers of fuel to newly built electric power plants. By as early as 1928 the peat extraction volume was 113,000 tons, which was 7.8 times higher than the 1913 level.

The fuel demand of the developing republics required accelerated development of fuel industry. Mechanization of peat production and the use of hydraulic, elevator and excavator extraction methods, which were more progressive in that era, made it possible to significantly raise the peat production volume within an extremely short time. By 1932 it was raised to 862,000 tons, and by 1940 it was increased to 3,361,000 tons.

Fraternal assistance provided by the union republics in restoring peat enterprises destroyed during the occupation by fascist German invaders and construction of new enterprises made it possible to exceed the prewar peat extraction level by as early as 1950 (the peat extraction volume was 3.78 million tons).

With the commissioning of the peat briquette plant in Usyazh in 1953 (its planned output capacity was 50,000 tons), a new era was initiated in development of Belorussian fuel industry--an era of all-out development of peat briquette production.

Introduction of progressive production processes, mechanization of production and a constant creative search for innovations permitted workers of Belorussian SSR

fuel industry to raise production to 2.2 million tons of peat briquettes per year, which is about 50 percent of nationwide production. There are now 39 briquette shops operating at 37 of the republic's enterprises. Pneumatic steam-and-water, pneumatic gas and steam cylindrical driers are now being used to dry peat. These different types of driers contribute 14, 29 and 57 percent respectively to the total briquette production volume.

A program of continual reequipment of the sector, introduction of progressive production processes and highly effective, dependable machinery and mechanisims, and mechanization and automation of production are promoting successful completion of the tasks.

During the 11th Five-Year Plan the sector's enterprises implemented more than 550 measures aimed at raising the technical level of production, and five new production processes were introduced. This made it possible to reduce the number of workers doing manual labor by 8.8 percent, and to free an equivalent of 110 workers.

The sector's enterprises are introducing track-padding machines, snow and vegetation removing equipment, cross tie replacement devices and track lifters designed by the BelNIItopproyekt [not further identified], making it possible to mechanize a significant part of the jobs associated with repairing and maintaining narrow-gauge railroad tracks. Efforts are being continued to create mechanized resources for laying temporary track at low-output enterprises and continuous-action machines for loading peat into narrow-gauge rail cars, making it possible to raise the labor productivity of peat loading by a factor of 2-2.5.

Scientific research and design work is being conducted with the purpose of improving briquette production and creating automated systems for controlling production and the quality of finished products. The peat briquette plants are now introducing systems for automatically controlling rail car feed and unloading, and systems for regulating drying processes for emergency injection of water into sprayers, for maintaining records on briquette production, for automatic stopping and starting of presses and for regulating briquette thickness. The latest achievements of Soviet peat briquette production and the results of scientific research by the BelNIItopproyekt were used to develop the Zhitkovichi Peat Briquette Plant, the largest in the USSR, in 1981. Its output capacity is 60,000 tons of briquettes per year, and it uses a pneumatic gas drying system. This was followed in 1982 by the commissioning of a peat briquette plant in Torbolovo with an output capacity of 30,000 tons of briquettes per year.

The Belorussian SSR Ministry of Fuel Industry is also devoting attention to development of agricultural production. Each year the sector's enterprises recultivate more than 3,000 hectares of depleted land and return it for use to the former land users. Scientific research is being conducted to seek effective ways of utilizing recultivated peat fields. An effort is being made to create the technology for producing peat substrates with improved agrotechnical properties to grow vegetable sprouts, the procedures for making "Dvina" nutrient peat soil were developed and an experimental lot was produced, and planning and estimate documents for construction of a plant producing peat pots are being drawn up.

Specialists and scientists of the RSFSR and the Lithuanian, Latvian, Estonian and Ukrainian union republics are providing constant help in developing new directions of using peat.

The BelNIItopproyekt and the Beltoplivostroy trust are making a significant contribution to completing the tasks facing the sector. The BelNIItopproyekt is providing all new construction projects with planning and estimate documents, and it is conducting scientific research and experimental design work aimed at creating new production processes, automating peat briquette production and mechanizing manual labor. The institute's plans were used as the basis for building peat briquette plants in Starobin, Lyakhovichi, Vitebsk, Dneprovskiy, Ditva, Zhitkovichi and Torbolovo, Belorussia's largest peat enterprise in Sergeyevichi and others. The institute's scientific research is aimed at solving the following problems: developing new and improving existing processes for preparing peat deposits for exploitation, and peat extraction, transport and processing; developing the technical resources for mechanizing manual labor; creating highly productive and automated equipment for peat briquetting and processing; raising the reliability and life of machines and mechanisms used in the sector.

The Beltoplivostroy trust is performing the principal construction and installation jobs for the sector. In 1 year and 9 months of the current five-year plan the trust has assimilated 17.5 million rubles, it has prepared peat deposits containing 275,000 tons of peat for exploitation, and it has built 17,700 square meters of housing space and preschool institutions with a total capacity of 90 children.

The sector's efficiency experts and inventors made a worthy contribution. Thus far in the 11th Five-Year Plan 1,467 efficiency proposals were submitted, there were 13 favorable decisions on inventions, and 1,375 efficiency proposals and seven inventions were introduced into production with an economic impact of 1,029,000 rubles.

The collectives of enterprises in Belorussian fuel industry were successful owing to constant research on and utilization of the best work experience and creative cooperation with collectives of the RSFSR Ministry of Fuel Industry, the Lithuanian and Latvian SSR peat industry administrations and the ministries of local industry of the Estonian and Ukrainian SSR.

The Belorussian SSR Ministry of Fuel Industry has determined the objectives of the 11th Five-Year Plan, among which the most important are:

improving the fuel transport network with the purpose of satisfying the fuel demand of the population and of municipal and private consumers;

increasing production of fuel for municipal and private consumers by extracting finer-sized peat;

improving wages and labor organization with the purpose of raising the effectiveness of production at all of its levels;

expanding production of new, highly effective peat products to satisfy the growing demand of agricultural production in the population;

reducing the number of manual laborers by 10.4 percent by creating fully mechanized tools, automating labor and introducing new production processes.

Inspired by decisions of the 26th CPSU Congress and the 19th Congress of the Belorussian Communist Party, the collectives of industrial enterprises belonging to the Belorussian SSR Ministry of Fuel Industry are successfully completing their second year of the 11th Five-Year Plan. The sector's enterprises are now laying a firm foundation for fulfilling the 1983 plan. The experience of previous years has shown that the most important work of the sector--peat extraction--depends to a significant extent on the quality with which repairs are performed at production areas and on production equipment, and the quality of personnel training. The sector is devoting special attention to these issues: Calendar plans for repairs at production areas are being drawn up for all enterprises, production equipment is being subjected to planned preventive maintenance, and improvements are being made in wages and labor organization.

The positive results achieved in the 1981 and 1982 seasons induce confidence that the sector's collective will successfully reach its objectives.

11004
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UDC 622.331

STATUS, PROSPECTS OF RSFSR PEAT INDUSTRY SUMMARIZED

Moscow TORFYANAYA PROMYSHLENNOST' in Russian No 12, Dec 82 pp 2-4

[Article by RSFSR First Deputy Minister of Fuel Industry B. N. Sokolov: "Peat Industry on the 60th Anniversary of the USSR's Formation"]

[Excerpts] As with other sectors, peat industry has transformed into a highly mechanized sector of the country's national economy since five-year plans were initiated. While during the first two five-year plans peat was extracted mainly in the RSFSR, it is now dug in seven union republics. Each year the industrial ministries of the country's republics extract about 90 million tons of peat.

Peat is a specific natural mineral. Its high organic content, its great moisture content, its high capacity for gas absorption, its low density and other properties permit its use as a raw material from which to acquire a broad assortment of products for different sectors of the national economy.

Five basic directions have been adopted in the USSR for integrated use of peat deposits, peat and products made from it: fuel and power, agriculture, biochemistry and thermochemistry, medicine and nature conservation.

Peat industry developed initially in the USSR in support of the fuel and power direction. Peat was dug as fuel in a volume necessary to support fulfillment of Lenin's plan for electrifying the country. In correspondence with this plan, five large--for that time--peat-burning thermal electric power plants were erected: Shaturskaya, Ivanovskaya, Gor'kovskaya, Leningradskaya and Kalininskaya. Their total output capacity was 170,000 kw.

Today the electric power plants operating off of peat fuel in the USSR have a total output capacity of more than five million kw. Peat-burning electric power plants with an output capacity of 600 Mw each are being built in Vologda, Pskov and Sverdlovsk oblasts.

Further development of power engineering based on peat fuel required an increase in peat extraction coupled with maximum mechanization of the production processes. In order that a fully mechanized method of peat extraction could be developed, specialized scientific research and planning institutes had to be created and machine building enterprises producing peat-digging equipment had to be built.

Today, peat is not only a fuel used for power production but also a highly valuable product in agriculture. In the last 10 years the volume of peat extracted for agriculture grew significantly owing to construction of specialized enterprises and sections. While in 1972 11 million tons of peat were extracted for this purpose, the figure in 1982 was about 40 million tons. In this case the volume of extracted peat used as bedding material, as soil in hothouses and various substrate blocks in nutrient mixtures, in peat flowerpots and so on increased significantly. Thus peat enterprises of the Lentorf peat digging production association have been producing and supplying consumers with peat fuel, peat for bedding and composting purposes, peat-mineral fertilizers, peaty limed and hothouse earth, substrates of various compositions, AMB [not further identified] earth, hollow peat pots and peat substrate blocks for growing vegetable sprouts and other agricultural crops.

Chemical and microbiological processing of cut peat produces alcohol, furfural, nutrient yeast, physiologically active substances for plants and animals, medical preparations and so on.

The RSFSR, the Belorussian SSR and the Baltic republics produce miniature hotbeds, concentrated organomineral fertilizers in small packages, miniature garden plots, nutrient briquettes and other products for outdoor and hothouse farming.

The USSR has created a production process and the equipment for growing, cutting and planting peat sod carpets, which are now being produced in the RSFSR, the Belorussian SSR and the Baltic republics.

Use of peat as fuel will expand significantly to satisfy municipal and personal demand, which is why peat briquette production is being developed. The country is now producing 5 million tons of briquettes annually. The Belorussian SSR Ministry of Fuel Industry is the leader in briquette production and development of peat briquette production.

The Soyuzmeliormash All-Union Industrial Association is responsible for providing the peat sector with the basic machinery and equipment used to dry and prepare peat deposits and to dig peat. Seven plants of this association manufacture 26 kinds of peat machines, excavators and cranes insuring full mechanization of the main laborious operations.

The peat machine building industry not only provides machinery and equipment to industrial peat enterprises in our country but also exports it.

A significant amount of attention is being devoted in scientific research to developing peat extraction processes that compensate for yield reductions caused by unfavorable weather conditions, to artificial dehydration of peat, to development of automated systems for controlling peat extraction processes, to automation of peat processing and to raising the quality and effectiveness of products made from peat.

Other important problems associated with technical progress in the peat sector are concerned with developing and assimilating technical resources intended for

full mechanization of auxiliary operations. These resources must promote a decrease in the number of production personnel and reduce the difficulty of some laborious manual operations, especially in transportation and in equipment repair.

The country's peat industry workers were given new important tasks associated with implementing the decisions of the May (1982) CPSU Central Committee Plenum. The following is stated in the USSR Food Program adopted for the period to 1990, in the section titled Development of the Material-Technical Base of the Agro-industrial Complex: "Complete and sensible use of all available sources of organic and other local fertilizers must be organized in every farm, and the volume of efforts to prepare composts from peat, limed materials, phosphorite meal and other fertilizers must be expanded. Use of organic fertilizers in the kolkhozes and sovkhozes must be increased to 1.2 billion tons in 1985 and to not less than 1.5 billion tons in 1990. Extraction of fuel for compost preparation and for bedding must be increased to not less than 170 million tons per year in the 12th Five-Year Plan."

In the 11th Five-Year Plan peat industry workers of the RSFSR Ministry of Fuel Industry must extract and provide agriculture with 148 million tons of peat, and by 1985 they must increase production of substrate blocks to 50,000 m^3, of nutrient briquettes to 175,000 packages and of peat pots for growing sprouts to 180 million units. In this case the volume of peat-based goods sold to the public will increase to 4.3 million rubles.

In order that agriculture's demand for peat and products made from it could be satisfied more fully, not only must the extraction and production volumes be increased in the traditional regions, but also peat extraction must be initiated in areas where it had not been used before. Peat enterprises with a capacity of more than 1.5 million tons will be built in Siberia and the Far East.

Jointly with scientific research and planning organizations, the industry's enterprises are implementing a program of measures to return spent peat digging sites to national economic uses. A total of 10,000-15,000 hectares will be made available for various agricultural purposes.

11004
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SYNOPSES OF ARTICLES IN 'TORFYANAYA PROMYSHLENNOST'' JANUARY '83

Moscow TORFYANAYA PROMYSHLENNOST' in Russian No 1, Jan 83 p 32

UDC 622.331(467)

BELORUSSIAN SSR PEAT INDUSTRY ON THE 60th ANNIVERSARY OF THE USSR'S FORMATION

[Synopsis of article by G. A. Filippov, pp 2-6]

[Text] The history of the development of Belorussian SSR fuel industry is briefly described. The work results of the industrial enterprises are presented, and the advances in introducing resources for automating and mechanizing manual labor into the sector's enterprises are reflected. The objectives of the enterprise collectives for the 11th Five-Year Plan are determined. Seven illustrations.

UDC 622.331:62-736

DEVELOPMENT OF PEAT EXTRACTION PROCEDURES PROVIDING FOR ARTIFICIAL DEHYDRATION

[Synopsis of article by B. A. Bogatov, G. A. Kuptel', N. I. Berezovskiy and F. G. Khalyavkin, pp 6-9]

[Text] The results of dehydrating peat in cyclic and continuous action centrifuges and of drying peat in electromagnetic units are examined.

Using these methods of artificial dehydration in cut peat extraction processes is proposed. The influence of different centrifugation parameters on the results of peat dehydration is analyzed. Four illustrations.

UDC 662.812:621.928.97

USE OF WET DUST TRAPS IN PEAT PRODUCTION

[Synopsis of article by B. M. Lebedev, N. V. Strel'nikov and Z. T. Bolotnikova, pp 10-11]

[Text] The possibility of using a slotted wet dust trap to remove peat dust from air exhausted from the production buildings of peat industry is investigated. An original design of a laboratory unit is described; the research results are presented, and the effectiveness with which a wet slotted dust trap removes peat particles with a nominal diameter less than 250 μ from air is demonstrated. One table, one illustration.

UDC 622.812:658.567.1

SUITABILITY OF REMOVING DUST FROM THE VALVES OF HOPPERS AT A PEAT BRIQUETTE PLANT'S BRIQUETTE STORAGE SITE

[Synopsis of article by N. V. Kislov, V. V. Shavel', P. V. Tsybulenko et al., pp 11-13]

[Text] The results of analyzing the concentration of fines in a flow of briquettes being unloaded from a hopper are presented, and the need for utilizing these fines is demonstrated. One of the variants of a system for utilizing briquette fines at a peat briquette plant is described. One table, three illustrations, three bibliographic references.

UDC 553.97.628.13

CHANGE IN COMPOSITION OF WATER IN RESPONSE TO FLOODING OF PEAT FIELDS

[Synopsis of article by V. P. Shmatova, N. A. Kot and V. A. Afanasenko, pp 13-15]

[Text] It is demonstrated that flooded peat fields change the hydrochemical indicators of water within broad limits depending on the form, quantity and composition of the peat and the time of contact between peat and water. Two tables.

UDC 662.331.004.4

PROTECTION OF CUT PEAT FROM SELF-HEATING AND SPONTANEOUS COMBUSTION

[Synopsis of article by A. P. Gavril'chik, pp 15-18]

[Text] Self-heating and spontaneous combustion of peat during storage is studied, and the ways of inhibiting this phenomenon are shown. Three bibliographic references.

UDC 622.331:658.562

PROBABILITY CHARACTERISTICS OF THE DENSITY OF CUT PEAT AT A GIVEN RELATIVE MOISTURE CONTENT

[Synopsis of article by V. A. Yeryshov, Ye. M. Davydova and Ya. V. Vorotnikov, pp 18-20]

[Text] Use of a linearized expression for the density of peat at a given relative moisture content is proposed. Determination, on the basis of the above, of expressions for the mean and standard deviation of this density depending on similar characteristics associated with natural moisture content and for the coefficient of correlation between them is suggested. Numerical examples of accuracy evaluation are presented. One table, three bibliographic references.

UDC 622.331:624.131

RESULTS OF RESEARCH ON PHYSICAL PROPERTIES OF PEAT AT NEGATIVE TEMPERATURES

[Synopsis of article by P. N. Davidovskiy, pp 20-22]

[Text] The results of research on physical properties of peat from the central zone of the USSR and from the Far North at negative temperatures are briefly presented. Five bibliographic references.

UDC 622.4:621.869.2

DESIGNS OF NARROW GAUGE RAILROAD TRACKS AT TRANSLOADING POINTS

[Synopsis of article by V. Ya. Il'in, I. I. Pavlov and Ye. M. Fedotochkin, pp 23-24]

[Text] A design is proposed for development of the railroad tracks of a peat transloading point where narrow gauge tracks (750 mm) join wide gauge tracks (1,520 mm) making it possible to increase the operational productivity of car dumpers and improve other operational indicators of peat transport. One table, four illustrations.

UDC 622.331:621.869.58

AN EXPERIMENT IN CONTAINERIZED SHIPMENT OF PEAT

[Synopsis of article by D. M. Kotel'nikov, V. S. Viktorov, V. I. Simonov et al., pp 24-27]

[Text] Experimental shipment of peat in containers by the Izhtorf, Lentorf and Gor'ktorf associations is generalized. The shipment conditions encountered in different times of the year, including times of negative ambient air temperatures, are analyzed. It is established that containerized peat shipment can insure regular shipment of peat throughout the year in different weather conditions. Three tables, two illustrations.

UDC 622.331:615.322

PEAT--A RAW MATERIAL FOR THE MEDICAL PREPARATION 'TORFOT'

[Synopsis of article by G. B. Naumova, R. V. Kosobokova, N. L. Korenevich and I. L. Kuleshova, pp 27-28]

[Text] The results of research aimed at selecting peat for production of the preparation "Torfot" and its standardization are presented. One table, four bibliographic references.

UDC 553.97:543.816

DETERMINATION OF THE ASH CONTENT OF PEAT AND PEAT PRODUCTS FOR AGRICULTURE

[Synopsis of article by L. M. Kuznetsova, V. N. Bulganina, T. M. Dorogina et al., pp 29-31]

[Text] The need for improving the method of determining the ash content of peat and peat products used in agriculture is demonstrated. The way in which these products can be used is determind by the quantitative and qualitative composition of the ash.

The influence of incineration temperature on the composition of the mineral fraction is established and explained. Three tables, three bibliographic references.

11004
CSO: 1822/200

NUCLEAR POWER

ATOMIC POWER DEVELOPMENT DISCUSSED

Moscow ENERGETIKA I TRANSPORT in Russian No 6, Nov-Dec 82 pp 92-97

[Article by V.A. Sidorenko: "Tasks of Atomic Power Development and Scientific Support"]

[Text] Atomic power is gaining increasing industrial use in the national economy. A state program has been formulated for accelerated increase in atomic power plant capacity. This raises a whole set of tasks for scientific research institutions, to improve atomic power plant reliability and efficiency and provide scientific support for their construction and operation. At the same time, it can now be confidently stated that atomic power must become a main component in the long-term development of the country's fuel and energy complex, whereby the optimum development route for such a complex is directly dependent on the directions of effective atomic power development. Scientific research must thus be aimed at both short- and long-term problems. The latter are all the more important in view of the large time lag in the fuel and energy complex, meaning that an extensive program of scientific research and experimental design work aimed at solving long-term fuel and energy problems must be completed early.

The restructuring of the energy balance for th 1980-2000 period provides for an increase in the absolute and relative growth in power resource production after the year 2000 through coal and atomic energy. An important economic task is to determine the optimum proportions between coal and nuclear power sources.

In the perspective considered, atomic and coal power must provide the major part of heat and electricity production. A main issue in this development of the energy balance is definition of the relation between coal and nuclear fuel in heat and electricity production. Optimizing the energy balance development will depend on various factors, an important one of which is the mastery and efficiency of different new technological processes and power units. The necessary development directions are influenced by the specific nature of the country's power development: the geographic remoteness of fuel production areas (including coal, in the long run) from the main areas of energy consumption (the European part). Transport costs are decisive in the final cost of coal.

Atomic power is currently being developed in the areas of electric power generation, where atomic power sources have already proven their competitiveness.

Methods for optimum solution of problems arising in the fuel and energy complex will primarily depend on the possible scale of atomic power introduction in heat generation beyond the electric power industry.

On formulating the task of raising atomic power heat generation, we first encounter the necessity of developing and mastering the respective power sources (domestic heating atomic plants (ATS); domestic and industrial heating atomic plants (ASPT) based on low-temperature reactors; atomic heat and electric power stations (ATETs);

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On formulating the task of raising atomic power heat generation, we first encounter the necessity of developing and mastering the respective power sources (domestic heating atomic plants (ATS); domestic and industrial heating atomic plants (ASPT) based on low-temperature reactors; atomic heat and electric power stations (TETs); industrial atomic power stations (AETS) based on high-temperature reactors) and high-efficiency long-distance heat transport (in conjunction with high-temperature nuclear power sources: ASDT).

The extensive introduction of atomic power into heat generation creates the possibility of examining larger-scale versions of nuclear power participation in the long-term energy balance, while formulating another range of tasks related to achieving economically optimum ways of providing nuclear fuel for a multi-function atomic power industry.

For the long term, the possibility is being considered of using atomic power to provide fuel for transport and chemical raw materials for industry, based on implementing a program of nuclear hydrogen power enginerring and giving prority to development of specialized, high-temperature reactors and mastery of an efficient technology for producing hydrogen from water.

The detailed internal structure of atomic power; i.e., the optimum relations between various types and purpose of atomic power sources, will appear from a detailed analysis of characteristic users and their location, development dynamics, the technical and economic characteristics of nuclear power sources, etc. A rough guide to feasible target dates for the beginning of industrial adoption would be: AST, 1985; ASPT, 1990: AETS and ASDT, 1995. Combined heat and electricity generation at ATETs, AETS AND ASDT turns out to be effective. The inevitable consequence of this is that siting of these atomic power sources will be accompanied by the simultaneous entry into production of their associated electric capacity, and will thus affect the energy balance's structure.

The most important property of atomic power, revealed by analyzing the prospects for supplying the fuel and energy complex with nuclear fuel, is its "elasticity." A necessary condition for providing fuel to a large-scale, multifunction atomic power industry is the extensive development of breeders. The optimum structure of atomic power is considered the two-component one (breeders and thermal reactors, meeting the optimum specific tasks), adaptable to possible primary nuclear fuel resources. Research demonstrates that the developing nuclear power industry handles the wide range of projected nuclear fuel conditions (supplies and production cost) with a modest change in total cost for its development, through internal restructuring: changing the ratio between breeders and thermal reactors, introducing improved breeders, and refining thermal reactors and elements of the external fuel cycle. In doing so the nuclear power industry must not lose its main advantage: the low proportion of fuel cost in the overall structure of economic indices. The large time lag in the entire fuel and energy complex must be again emphasized here, as it is directly relevant to its nuclear branch. From this directly follows the importance of the extensive, promising NIOKR program, which must include assimilation of efficient breeders, improvements in fuel conversion in breeders, steady improvements in fuel cycle performance characteristics, systematic improvements in the fuel cycle of thermal reactors, and introduction of improved thermal neutron systems.

In formulating the atomic power industry's long-term tasks, it is very important to note that there are no grounds for advancing safety and ecology arguments as constraints on atomic power development, which can occur at the scale required by national economic tasks given an optimum specific and regional structure.

The fact that the source of nuclear power carries a specific danger (is a source of ionizing radiation and radioactive matter) not found with most other technical devices has necessitated special equipment and techniques for protecting operating personnel and the public. Radiation protection measures were thus the object of special attention from the very first days of atomic power development, and are constantly being upgraded in solving new tasks of the developing atomic power industry.

Technical solutions to ensure safe normal operation of atomic installations are being constantly tested in practice. Their refinement is based on clear-cut quantitative indices. Operational experience convincingly demonstrates the effectiveness of the protective means employed and the practicable safety of nuclear facilities, providing the basis for solving new tasks in this direction, in all areas of further atomic power development.

Safety during emergencies in a nuclear power plant is ensured by a whole series of overlapping technical and organizational measures and means. This approach compensates for the insufficiency of acutal operating statistics in this area of safety, and its related conditional nature of quantitative indices. The following set of nuclear power safety measures is used in practice: high quality of equipment manufacture and assembly; equipment inspections at all operating stages; development and implementation of effective technical measures for preventing accidents, handling disruptions that occur and reducing their damage; development and implementation of means for localizing radioactive matter in an emergency; consistent performance of all technological and organizational measures to ensure safety at all stages of plant construction and operation; standardization of technical and organizational safety; and a governmental inspection system.

The on-going process of constantly improving safety approaches is related to the changes in the objective conditions of atomic power development. The transition from first-generation pilot industrial AES's to their large-scale construction, with construction of AES's of several tens of gigawatt capacity planned for a 10-15 year period, has created new AES safety requirements and equipment design standards. In particular, in 1971 the document "General Conditions for Ensuring AES Safety" went into effect. It defines the level of safety requirements to be met by modern power plants. The appearance of new aspects in the use or situation of atomic power sources (for example, seismics, heat supply tasks) results in a review of existing requirements and normative documents and formulation of new ones. For example, initiation of AST construction has meant solving specific safety questions related to bringing the atomic power source close to a large populated area, and the necessary elimination of radiation effects on heat users through the network heat-transfer medium. The necessity that they be solved is dictated by special technical requirements supplementing the saftey regulations for ordinary AES's.

Research done so far, based on current concepts and available quantitative date, indicates no practical limitations on atomic power source siting and the scale of atomic power development from the standpoint of radiation safety. Long-term forecasts of the fuel and energy complex raise the question of the land's "ecological capacity", especially that of the European part of the country. This is done for nuclear power plants as well, and the necessity of answering it might require future refinements in the approach to atomic power source safety.

Ensuring safety is thus an important long-range task of the nuclear power industry, whose successful completion requires constant effort to raise the efficiency and economy of protective measures.

The features and goals of atomic power development cited yield several concrete issues on which scientist working on this part of the fuel and economic complex should concentrate their efforts.

The most important task of current development is to ensure the reliable and economic operation of operating and planned AES's in accordance with the adopted program. The following tasks can be noted in this connection:

Development and adoption of equipment inspection techniques and diagnostics methods. A theoretical or equipment solution for individual subsystems currently exists for this area. The following developments for such inspection means, at various stages of introduction, can be singled out: acoustic-noise diagnostics (detection of equipment damage in complex systems); acoustic emission (continuous and periodic monitoring of flaw occurence in the metal of major power elements of equipment); neutron-noise and similar systems (monitoring disruptions of operational conditions and mechanical damage in the reactor's active zone); and devices for remote monitoring of metal (for periodic control in large radiation fields).

These systems' reliable operation is important for both efficient AES operation (raising overall equipment and plant reliability indices, reducing operating personnel, lowering maintenance and repair labor costs) and constantly raising safety.

Creation of specialized means for repairing equipment operating in specific radiation conditions. An important organizational task is to ensure centralized equipment maintenance and repair.

Ensuring optimum fuel cycle management during AES operation (improving reactor design methods; planning fuel overloads; optimizing AES fuel use).

Ensuring a high level of personnel training.

Raising the level of AES monitoring and control automation, and standardizing automation and control means. New solutions, corresponding to the new technical level and new theoretical approaches to automating technological process control, must be prepared and introduced in new generations and series of power plants. Individual elements and means of monitoring and control must be improved at the same time. Creation of parameter sensors of the reactor coolant without removal of the agent and raising the reliability of means for intrareactor monitoring should be singled out.

This problem's solution must be combined with optimum organization of operation and reduction inoperating personnel.

Several important technological problems periodically arise, connected with equipment manufacture or management of construction and assembly work; for example, creating reliable and inexpensive anticorrosion coatings of reactor circuit equipment, and ensuring reliable sealing of reactor circuit facilities (shells and passageways).

An important and necessary condition for raising the technical and economic efficiency of atomic power as a young, fast-developing sector is to combine the inevitable systematic step-by-step introduction of new technical solutions with their standardization and unification. This must naturally include development of the capacity and parametric series of nuclear power sources.

In creating nuclear power sources as heat supply facilities, the largest number of fundamentally new problems arises in developing a high-temperature reactor

and its systems for heat transformation and transmission. The most important of these are: development of high-temperature nuclear fuel, fuel elements and absorbers for thermal and fast neutron reactors; development of special high-temperature materials for reactors, heat exchangers and other equipment; study and ensurance of radiation resistance of high-temperature reactor materials; development of gas-turbine helium plants; development of specialized heat exchange, heat conversion and other units; assimilation of helium technology, especially development of helium purification and purity control systems; and development of processes for complete use of nuclear reactor high-temperature heat for ferrous metallurgy and the chemical industry.

The creation and improvement of breeders has resulted in a specific range of problems related to creation of special materials that are corrosion and radiation resistant under fast reactor conditions (at a fast neutron fluence exceeding 10^{23}) with respect to various coolants (sodium, helium, steam), in addition to the usual problems connected with any reactor systems. Along with creation and improvement of sodium breeders, sufficient attention must be paid to alternative versions; in particular, those based on steam coolant technology. Use of a new technology inevitably necessitates studying both thermohydraulic and technological-material issues (creation of fuel and absorbing materials, etc).

The maneuverability of nuclear power plants merits special attention in atomic power development.

The characteristic structure of nuclear power source economic indices (in converted costs for generation of a unit of electricity at an AES, about 70% is for the capital component, and about 30% for fuel) results in a high sensitivity of the converted costs to the plant load factor. Characteristic half-peak conditions, with a load reduction during nighttime power use and weekly shutdown for 1-2 days (days off) lower the load factor from the usual 0.8 to around 0.45. This requirement complicates the technological scheme and raises fuel element design costs; the total increase in converted costs for generation of electric power more than doubles. An atomic power source should thus be viewed not as a primary source for covering the variable portion of electricity consumption, but rather as a backup. AES and reactor designs should be adapted to ensure the feasibility of operating in such a mode when absolutely necessary. This should invlove ensuring stability of the reactor energy release fields given substantial power variations, developing a reactor control and protection system capable of functioning given quick reactivity changes, and creating the required equipment elements capable of withstanding multi-cyclic power variations (up to 10,000 times in a service period). All this generally does not entail fundamental difficulties, but does require specialized designs.

Specific problems arise when making fuel elements that guarantee tightness under such condition (around 1000 cycles during the fuel operation time). In any of the presently envisaged systems for reliably solving this problem, the fuel cost is higher than at present. It should also be remembered that switching fast breeders to operation with a low load factor not only worsens their economic indices, but is simply inacceptable because of the drop in the nuclear fuel conversion rate; i.e., it impedes performance of their primary function. The problem should obviously be resolved in stages, parallel to the development

and introduction of the basic means for covering the variable portion of the load with non-nuclear fuel. The first stage should place very moderate requirements on AES maneuverability (a daily load reduction in the range of 15-20%). Combining the AES with various power cells is being studied as a promising approach. It is also attractive in that the cells can be used in both thermal neutron reactor stations and in breeders. The optimum types of energy storage can vary with different nuclear plants: from mechanical (hydraulic accumlators and gas compression) and thermal, to chemical (synthetic fuel production using high-temperature reactor heat).

Conclusion. Atomic energy must become a leading component in the long-term development of the country's fuel and energy complex.

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WAYS OF HASTENING COMPRESSOR STATION CONSTRUCTION DISCUSSED

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[Article by A. M. Krayzel'man, chief, Main Production Management Administration, Minneftegazstroy: "Organizing Development of Pilot Complexes, and Planning and Organizing Construction of Compressor Stations"]

[Text] Approved by the 26th CPSU Congress, the "Basic Directions of the USSR's Economic and Social Development in 1981-1985 and in the Period to 1990" established the quotas of increasing gas extraction to 600-640 billion m^3 by 1985, to include increasing gas extraction in West Siberia to 330-370 billion m^3. In this connection, supporting the planned growth of gas extraction in West Siberia and solving the problem of its transportation into the European part of the country are becoming the most important elements of the energy program for the 1980s.

The scale of construction of gas pipelines with a diameter of 1,420 mm is growing dramatically. While in the 10th Five-Year Plan more than 10,600 km of gas pipelines of this diameter were erected, 23,000 km are to be laid in the 11th Five-Year Plan.

Transportation of gas through the main pipelines will require erection of 330-350 compressor stations, of which 260-280 must be built by the efforts of our ministry's construction organizations. As the diameter of gas mains increases, the relative output capacity of the gas pumping units must increase.

The year 1983 is the most intense in the 11th Five-Year Plan in terms of construction and commissioning of compressor stations. While in 1981 38 compressor stations were placed into operation, and 43 were commissioned in 1982, this year we are to make 68 compressor stations operational (to include 10 in the first quarter, 29 in the second, 11 in the third and 18 in the fourth). Some of these are associated with the most important construction projects--10 on the Urengoy-Pomary-Uzhgorod export gas pipeline and 22 on the Urengoy-Novopskov gas pipeline. Most compressor stations are to be erected on a compressed schedule in significantly less than standard time.

Moreover a considerable volume of preparations for construction of compressor stations, to be placed into operation in 1984, must be completed in 1983.

The 1984 plan foresees commissioning of 14 compressor stations on the Urengoy-Uzhgorod gas pipeline in the first quarter, and 19 compressor stations on the Urengoy-Center gas pipeline (nine of these are to be commissioned in the second quarter).

In order to reduce the time for erecting compressor stations, the ministry is making an effort to improve the technical and structural concepts embodied in the compressor stations, to reduce the cost and laboriousness of their construction and to raise reliability.

In the 1970s, the gas pumping units that were used in the compressor stations supporting gas mains were delivered to the construction site in the form of individual units and parts, and installed on a monolithic foundation 4-5 meters high.

The buildings intended to house compressor shops and auxiliary services were made predominantly out of brick. Introduction of progressive structures and materials was slow. The labor-intensiveness of compressor station construction attained 200,000 man-days.

Because manpower was limited, the number of compressor stations placed into operation each year in 1970-1973 did not exceed 10-12, which was not in keeping with the needs of the country's developing gas transport system.

At the end of the 9th and in the 10th five-year plans the main directions of scientific-technical progress included reequipment of compressor stations with new highly effective equipment and with modular gas pumping units having a higher output capacity, and introduction of the modular construction method.

Beginning in 1973 modular units enjoyed increasingly greater application in the construction of compressor stations for gas mains. Depending on the availability and type of enclosing structures, the modular units of compressor stations are subdivided into exposed, containerized and boxed.

The modular method of compressor station construction essentially entails complete manufacture of the modular units at specialized plants in rear bases, followed by delivery of the modules to the construction site, where they are assembled. This method is especially effective in building compressor stations in northern and remote regions, where labor productivity can be quadrupled and many thousands fewer laborers would be required.

In the 10th Five-Year Plan the modular method was introduced into the construction organizations of the Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] which, together with the other directions of scientific-technical progress, played a positive role and permitted a doubling of the number of compressor stations placed into operation annually.

The efforts to improve the modular construction method and to raise its effectiveness in relation to construction of compressor stations are being

conducted in accordance with the "Interdepartmental Specific-Purpose Scientific-Technical and Production-Economic Program for Further Development (to 1985) of Modular Construction of Petroleum and Gas Industry Facilities."

Measures implemented in recent years in support of this program made it possible to reduce the average construction time of compressor stations to 19 months in 1980-1981.

Measures implemented by the ministry in response to a decree adopted by the CPSU Central Committee on the efforts of the Minneftegazstroy to reequip and introduce progressive methods into construction are aimed at reducing compressor station erection time by 1.5 times through the further development of the modular construction method. This means that a compressor station construction rate insuring that construction time would not exceed 12 months will have to be achieved in this five-year plan.

Compressor Station Pilot Complexes

Capital investments into compressor station construction are the most effective when output capacities are placed into operation in stages, as pilot complexes. Special attention must be turned to developing, coordinating and approving pilot complexes, inasmuch as completion and acceptance of the construction of a single pilot complex allows the construction organization to be credited with completion of a construction project.

The planning assignment foresees development of pilot complexes as part of the general construction plans. Two pilot complexes containing six and two, four and four or five and three machine units, depending on their type, are established for each compressor station.

The pilot complex must be coordinated with the general contracting construction organization not later than 1 July preceding the planning year.

The planning materials for pilot complexes are drawn up as part of the plans (working plans) completed in response to a planning assignment and containing a statement indicating that the planning and estimate documents for pilot complexes must be developed. A certificate indicating the estimated cost of construction of facilities to be included in the pilot complex and a certificate indicating the estimated cost of finished construction are attached to the summary estimate. The details of these planning materials and certificates must be coordinated with the working drawings within enough time to insure timely development of the capital construction plans and commissioning of the productive capacities, with a consideration for the actual status of construction of facilities for the pilot complex.

Pilot complexes of compressor stations should include: gas scrubbing and cooling units, and condensate collecting units; intershop production pipelines, or some proportion of them; the system of connecting pipelines for the force pumps, or some proportion of them; compressor shop equipment insuring normal operation of not less than two gas pumping units; a building to house the control room and power production unit, together with the equipment installed

as required by the plan; auxiliary and engineering support facilities (or some proportion of them), and public services and amenities.

After the details of the planning and estimate documents of the pilot complex are coordinated with the working drawings of the buildings and structures and with their estimates, they should include:

a brief explanation justifying the production capacities being introduced, the composition of the production operations, buildings, structures, utility networks, lines of communication and so on to be included in the particular pilot complex; the cost of construction of the facilities, and information on the requirements of the existing norms and rules of planning and construction and on requirements imposed on the plan by state inspection organs and by organizations that had issued the specifications concerned with connecting the facilities to networks, structures, shared lines of communication and so on;

an excerpt from the master plan for the enterprise or structure indicating the facilities to be included in the pilot complex;

an excerpt from the enterprise plot plan noting the locations of external lines of communication and structures (railroads, motor roads, utility networks, engineering structures etc.) included in the composition of the pilot complex;

an excerpt from the summary plan for internal utility networks, indicating the networks and structures of the pilot complex;

excerpts from the summary documents indicating the volume of basic construction and installation jobs, and a summary schedule indicating the demand for construction structures, articles, semifinished items and materials, and specifying the volume of construction and installation and the demand for structures, articles and construction materials for the facilities of the pilot complex, determined in detail on the basis of the working plans for the buildings and structures;

a document indicating the estimated cost of construction of the facilities within the pilot complex, drawn up on the basis of facility and local estimates and a report on actual assimilation of assets and anticipated assimilation of assets based on the attached forms;

a list of the modular units and preassembled connecting units;

specifications on the equipment and a document indicating the demand for materials for modular units prepared by installation organizations, and specifying the way equipment delivered to the assembly and outfitting bases of the installation organizations is to be allocated;

a general schedule for deliveries of equipment and materials by the client, indicating the entire list of equipment foreseen by the specifications in the order;

special conditions affecting production, supply and final adjustments, and the measures associated with them; this information should account for the

unique features of each construction site and the deadlines for fulfilling these measures, as coordinated with the contracting organizations.

Planning and estimate documents drawn up as part of the plan (the working plan) are coordinated and approved in the order established by the USSR Gosstroy instructions contained in SN [Construction Norms] 202-81. Prior to approval of the planning and estimate documents for the pilot complex, to be included in the composition of the plan (the working plan), the document indicating the estimated cost of construction of facilities contained within the pilot complex must be coordinated with the contracting organization, particularly in relation to the composition of the facilities and the cost, broken down among the different facilities included in the pilot complex. This document is used as the basis to draw up a document indicating the estimated cost of finished construction, which is then used as the basis for settling accounts for finished construction after the completed pilot complex is placed into operation.

Thus in the new system of management the planning and estimate documents of a pilot complex have the most important significance to the entire investment process associated with compressor station construction, and they serve as the basis for drawing up the plans for capital construction to be used in signing contracts, regulating mutual relationships between client and general contractor and settling accounts on finished construction.

Planning the Construction of Compressor Stations

Compressor stations are erected for gas mains in accordance with five-year and annual plans of economic and social development, and on the basis of the deadlines for commissioning productive capacities and facilities established by these plans.

The approved plan (working plan) of a compressor station and the plans (working plans) of its pilot complexes serve as the basis for planning and financing construction of such a facility, for ordering equipment and for signing contracts for capital construction.

The plans (working plans) for construction of compressor stations and their pilot complexes are approved by the Ministry of Gas Industry.

Prior to approval of a plan, the Ministry of Gas Industry coordinates with the general contracting construction and installation organization (the Minneftegazstroy or, on its instructions, a construction organization) on the section of the plan (working plan) titled "Organization of Construction" and on the estimates determined on the basis of the working drawings, and it submits the design concepts of the buildings and structures and the summary estimate of construction cost for approval.

One of the principal measures supporting accelerated erection and commissioning of compressor stations by the directive deadline (which is sooner as a rule than the standard deadline) is that of improving the planning of compressor station construction both within the ministry and at the intersector level.

Analysis of construction of compressor stations for the Urengoy-Gryazovets and Urengoy-Petrovsk gas pipelines showed that this is precisely where there are significant reserves for hastening attainment of the planned output capacity of gas transport systems.

The fact is that because of the absence of financing and of planning and estimate documents, builders complete three to four times less work in the preparatory period and in the starting year of compressor station erection than is necessary if production processes and construction organization are to be optimized as foreseen in SN 440-79. Thus by the end of 1980, the starting year for construction of 20 compressor stations for the Urengoy-Gryazovets gas pipeline, a work volume of 139 million rubles had to be completed according to the norms, and 29.2 million rubles worth of work was planned. The actual amount assimilated was 41.3 million rubles. Thus the amount of work done was almost three times below the standard.

A similar lag at the end of 1981, the starting year for erection of the Urengoy-Petrovsk gas pipeline, totaled 114 million rubles (more than four times less than standard). This year this negative trend increased even more, attaining almost 250 million rubles.

Delays in issuing the planning and estimate documents have a negative influence on the progress of construction and commissioning of compressor stations. Thus the planning and estimate documents required for the starting year of construction of compressor stations for the Urengoy-Petrovsk gas pipeline arrived in November 1980, rather than July 1979. Equipment was delivered far beyond the deadlines foreseen by the schedule. The lag was more than half a year for compressor stations of the Urengoy-Petrovsk gas pipeline.

To make up for lost time and to meet the directive deadlines, the compressor stations for the Urengoy-Petrovsk gas pipeline should have been built in 15 rather than 21 months. But the actual (average) time was 17 months (4 months less than the standard). To meet these deadines, the builders were forced to concentrate their resources at the construction sites 1.5-2 times more than would insure optimum production and organization. Moreover, jobs in the most laborious preparatory period and jobs associated with foundation construction had to be completed in winter. This increased the labor-intensiveness and cost of the work.

In such conditions there is practically no possibility for trusts and associations to plan the deadlines for commissioning the facilities in coordination with their quotas for finished production, for growth in labor productivity and for reduction of construction cost.

The order of planning compressor station construction must create conditions insuring optimum production and work organization in accordance with SM 440-79 and with the particular features of the routes, so as to promote growth of construction industrialization, reduction of the labor-intensiveness and cost of the work and improvement of its quality, and so as to insure erection of the gas pipelines and attainment of their planned output capacities within the directive deadlines.

This requires that the volume of assets planned and allocated for the first, starting year of construction would be enough to support a normal construction start. According to the standards, this volume would be (as a percentage of the cost of construction and installation) 39 percent if the facilities are to be introduced in the fourth quarter of the following year, 56 percent if they are to be introduced in the third quarter, 76 percent in the second and 92 percent in the first quarter of the following year.

Bringing the existing order of planning construction of compressor stations at the intersector level into correspondence with the optimum production processes and organization of modular construction will make it possible to introduce, within the sector, a system of planning the construction of compressor stations based on sector and regional plans of work organization, and network schedules creating favorable conditions for implementing the optimum construction procedures and for successive concentration of resources at the pilot complexes. A possibility will simultaneously appear for the trusts and associations to plan the technical-economic indicators of their activity in full correspondence with the schedule for construction and commissioning of the facilities. As a result conditions will be created for rhythmical construction on a flow line basis by stable collectives (khozraschet sections) that are compensated on the basis of their end product and that are headed by a brigade leader-foreman (chief foreman). These primary production collectives are precisely what must become the main object of planning. The system of planning, material-technical support and material stimulation should be oriented on the khozraschet section and the enlarged khozraschet brigade.

All of this will make it possible to impart, to the plan for construction and commissioning of facilities, that significance which is required in accordance with the party and government decree on improving the economic mechanism. The role of the plan--a powerful factor that increases organization, insures order at the construction site, work coordination and rhythmicity of production and that mobilizes the collectives to finish facilities within the directive deadlines--will rise.

The planning of compressor station construction must be tied in with the planning of surveying operations and with the schedules for delivering equipment, structures and materials, and it should foresee that volume of construction and installation which would be necessary to achieve sensible production procedures and work organization, as required by the standards.

Construction must be financed in a volume sufficient for a normal construction start.

Planning and estimate documents for the first year of construction must be published by 1 July of the previous year, and they must support the volume of work indicated above. Simultaneously documents must also be published in support of manufacture of the modular units that will be installed in both the starting year of construction and the final year. Otherwise it may turn out to be impossible to complete the organizational and technical preparations required for production.

It would be best to supply equipment in four stages.

The outfit of equipment, large units and shut-off valves installed during construction of the foundation must be delivered in the first stage. This outfit should arrive before the foundation work begins--that is, 18-19 months before the directive deadline for commissioning the facilities. Electrical equipment and materials in support of external electric power supply to the facility under construction should arrive simultaneously as a rule. This would make it possible to organize the supply of power to the builders from the state power network.

In the second stage the outfit of equipment necessary for the manufacture of modular units at assembly and outfitting enterprises (SKPs) should be formed. The schedule for delivery of this outfit must be determined by the timetable drawn up with a consideration for the output capacities of the SKP, the transportation to be used to deliver the modules and the deadlines for commissioning the facilities. This timetable must be approved by the Ministry of Gas Industry and the Minneftegazstroy.

In the third stage the outfit of heavy equipment to be installed on outdoor sites of the compressor station and in the compressor shop must be delivered. This outfit should be delivered the moment installation of the above-ground portion of the facility begins, simultaneously with delivery of the outfit of modules for the facility--that is, 9-10 months prior to the directive deadline for commissioning the compressor station and not later than 7 months. The fourth stage--delivery of electrical equipment, monitoring and measuring instruments and automated equipment not related to the modular units--must be completed not later than 4 months prior to the directive deadline for introducing the compressor station.

Thus implementing the measures planned by the Minneftegazstroy, placing planning into some effective order, developing the planning and estimate documents, allocating capital investments and delivering equipment in accordance with optimum production processes and optimum construction organization would make it possible to commission compressor stations by the directive deadlines.

However, it should be kept in mind that the production processes and organization of construction of compressor stations placed at the basis for the standard are optimum only if the existing space planning and design concepts for compressor stations are employed. As they are improved, the preconditions for developing new production processes, for organizing construction in a new way and (on the basis of the latter) for reducing the standard time for erection of compressor stations will be created. It is toward this end that the activities of sector institutes and design offices of the Minneftegazstroy. are targeted.

Organization of Construction, and the Unique Features of Organizational and Technical Preparation for Construction of Compressor Stations

Besides improving planning, introducing progressive planning and design concepts into the construction of compressor stations, developing capacities producing modular units and structures, installing supply lines above the ground on scaffolding, employing effective supply systems and using transportation and installation mechanisms of higher power, improvement of construction organization and especially of organizational and technical preparations for construction of facilities has great significance to hastening construction.

Construction of compressor stations proceeds in the following stages: organizational and technical preparations, a preparatory period, a main period, final adjustment operations and commissioning of the facility (the pilot complex).

Organizational and technical preparations (OTP) represent one of the most important stages of construction, and the effectiveness and quality with which compressor stations are erected depend in many ways on how promptly, thoroughly and well these preparations are made.

The client and the general contractor take part in the organizational and technical preparations for construction.

The client organizations issue the planning assignments; coordinate and approve the planning and estimate documents, and provide the general contracting construction organization with the complete set of planning and estimate documents by the deadline established by the standards; receive funds, place orders and draw up the timetable for delivering equipment and materials; organize the financing of construction; allocate land for construction.

During the period of organizational and technical preparation for construction the organizations of the general contractor determine which general contracting construction, installation and specialized organizations are to participate in construction; place orders and draw up timetables for deliveries of materials, structures and parts; draw up timetables for supplying machines, mechanisms and motor transport to construction sites; resolve issues concerning the housing of employees and providing cultural and personal services to them at the construction site; develop the organizational and production documents applicable to the preparatory and main periods of construction.

Thus integrated fulfillment of OTP by the client and contractor in support of construction predetermines successful completion of planning assignments associated with building and commissioning compressor stations.

The existing statutes obligate the client to supply the entire volume of working documents and estimates prior to 1 July of the year preceding the planning year. However, this requirement is not being satisfied even in relation to the principal gas pipelines of the 11th Five-Year Plan.

The working documents for the compressor stations of the Urengoy-Gryazovets-MOK [not further identifed] gas pipeline were 3-6 months late, while documents for compressor stations on the Urengoy-Petrovsk gas pipeline were 2-4 months

late. What this leads to can be seen in the example of construction of the Peregrebnoye compressor station on the Urengoy-Gryazovets gas pipeline.

The directive deadline for commissioning this compressor station was set at June 1981. According to the timetable coordinated with the client, construction was to have started in April 1980, and construction was to take 15 months, which is 6 months less than standard.

However, the technical documents were transmitted to the client 6 months late, as a consequence of which construction was delayed, and work did not begin at the site until October 1980. Owing to intensified concentration of resources, the station was built and placed into operation in October 1981--that is, within 13 months (in 8 months less than the standard), but the builders were unable to meet the directive deadline.

The delay in commissioning the output capacities of the Peregrebnoye compressor station on the Urengoy-Gryazovets gas pipeline was a direct consequence of violation of production discipline by the client's planning organizations, which failed to meet the deadline for issuing the technical documents in support of construction of this compressor station. A similar situation also evolved at other compressor stations of the Urengoy-Gryazovets gas pipeline (Nadym, Privodino, Nyuksenitsa, Yubileynaya, Mikun).

Delays in initiating the work at the compressor stations sites are also occurring owing to late allocation of land for construction and removal of existing structures. When OTP measures are left unfinished, construction organizations are deprived of the possibility for resolving the problems concerned with supplying materials, structures and parts to the compressor station construction sites in time, prior to the start of the main period of construction, and if we consider that a significant number of the compressor stations are being erected in regions devoid of year-round transportation links, the fact that they would not be able to initiate the main period of construction on time is understandable. This has been the case with most compressor stations on the Urengoy-Gryazovets-MOK and the Urengoy-Petrovsk gas pipelines.

Besides cases of deficient work on the part of clients, shortcomings are also noted in the work of contracting organizations in the period of organizational and technical preparation. Orders for structures and materials are submitted late. Sometimes the timetable for delivering construction structures is violated.

The foundation for success in fulfilling the compressor station commissioning plans is laid during the time of organizational and technical preparation for construction of a compressor station. During this period the planning and estimate documents must be thoroughly analyzed by engineers and technicians, the directive timetables for construction must be drawn up, orders for deliveries of structures and materials must be drawn up and the delivery timetables must be coordinated, and the production plans must be written up. All of this is within the responsibility of production preparation departments and

the technical and production departments of trusts, main administrations and Orgtekhstroy [not further identified] organizations. It should be noted that this work is not always found to be clearly organized. It is being completed only partially, and late. The main administrations and trusts must turn serious attention to reorganizing preparations for construction of compressor stations in accordance with the requirements of the standards.

The Preparatory Period

Preparation of a facility is one of the most important prerequisites of successfully completing construction and installation jobs in the main period of construction. Vertical planning and installation of approach roads to the compressor station construction sites, of roads leading to storage sites and of roads within the construction site are completed in the preparatory period at the compressor station construction site on the basis of the master plan for construction. Water and electric power supply must be prepared, and the reception and storage of materials, structures and equipment must be organized.

Warehouses belonging to the client and the contractor, the production base of the general contractor and the subcontracting organizations, a housing compound and social, cultural and personal service facilities are erected in the preparatory period. In a number of cases general contracting organizations do not devote adequate attention to improving the housing compounds and erecting cultural and personal service buildings. And yet, creation of normal housing and personal conditions for the workers engaged in erection of compressor stations is a guarantee of greater labor discipline and growth in the effectiveness of compressor station construction.

The Main Period of Construction

The construction and installation jobs and the activities of general contracting and subcontracting organizations must be clearly coordinated in the main period of construction. The construction and installation subdivisions must be specialized to a certain extent. Today the level of organization and of the production processes employed is becoming a no less important factor of raising labor productivity and reducing construction time than modular construction and production design concepts.

The main period of compressor station construction includes all forms of construction, installation and specialized jobs, which may be summarized as follows: mechanized earth-moving and pile driving (5 percent of the total volume of construction and installation); the laying of foundations, utility lines and roads within the construction site (38 percent); installation of frame-and-panel buildings, SKZ [not further identified] and module boxes (16 percent); mechanized installation (of machine units) and partial connection (1 percent); installation of production equipment and pipelines (18 percent); electrical jobs (4 percent); internal sanitary engineering and ventilation jobs (3 percent); trimming and insulating jobs (4 percent); installation of monitoring, measuring and automated instruments (3 percent); installation of communication, warning and radio systems (1 percent); site improvement (2 percent).

Introduction of the flow-line method is a progressive and effective means of intensifying compressor station construction. Especially today, the laying of multistrand gas pipeline systems creates favorable conditions for continuous construction of two or three generations of a compressor station at the same site within a particular period of time.

Jointly with the NIPIorgneftegazstroy [not further identified] institute, in 1977 the Kazymgazpromstroy trust developed an integral flow-line method of construction and installation, and introduced it into the construction of compressor stations on several gas pipelines. Since then, 25 compressor stations were erected by this method. The method significantly increased labor productivity and reduced construction time.

The integral flow-line method, which many construction and installation organizations of our sector have adopted, is based on the following principles of organization and production:

division of the entire compressor station construction site into five construction zones (this is particular to compressor stations equipped with GTK-10-4 units);

division of the main facility--the compressor shop--into different work areas to allow subcontracting subdivisions to begin their work quickly;

organization of specialized production teams in each of the zones, and the scheduling of their joint work on facilities of the compressor station;

combination of construction and installation jobs in the compressor shop zone with jobs associated with the "high" and "low" sides of the compressor shop;

preassembly and installation of metallic and enclosing structures of buildings, production equipment and pipelines;

assembly of units and blocks at special assembly sites;

introduction of the khozraschet brigade contract;

use of mechanized hand tools;

strict and efficient organization of construction and installation jobs, of material-technical supply and of the production control service on the basis of weekly-daily planning and control.

The method of separating foundation work from the above-ground portion of compressor stations was introduced in 1982 with the purpose of raising the level of organization and of the production processes involved in erection of compressor stations. This method allows the general contractor to complete all foundation work in the period of positive air temperatures and before the installation organizations arrive.

The main principle of the method is to lay "rough" floors and complete pile foundations for the compressor shop and for the "high" and "low" sides of the compressor shop, prior to the start of above-ground jobs.

The five zones of the compressor station construction site include the following facilities and structures: zone 1--sites and manifolds of the air cooling units, gas and dust traps, the transformer substations servicing the gas air cooling units, and the fuel, gas, igniter gas and impulse gas preparation block; zone 2--production pipelines leading from the manifold of the air cooling unit and dust traps, and the pipelines and fittings on the force pump connectors; zone 3--the building of the compressor shop (together with the SVP [not further identified] building); zone 4--unitized air cleaning units, air ducts and regenerators, gas conduits and smokestacks, and oil lines leading from the turbines to oil air cooling units; zone 5--facilities and structure of the auxiliary production services; power and fuel supply systems, warehouses, containers, PEB and SERB [not further identified], the dining hall and so on, together with the utility line connections. The construction and installation jobs of the main production period begin in three zones simultaneously, namely in zones 1, 3 and 5. The work proceeds in each zone according to the principle of separating the foundation work from the above-ground portion of the work. As the work in zones 1, 3 and 5 is finished, construction and installation jobs are begun in zones 2 and 4. This is done because of the limited number of pile-drivers available. After this deficiency is eliminated, the foundation may be worked on simultaneously on the entire site. This method should become the production norm for the construction of new types of compressor stations equipped with GPA-Ts-16, GTN-16 and GTN-25 gas pumping units.

As a rule zone 3--the zone containing the compressor shops--predetermines the time it takes to build the whole compressor station. This is why the compressor shop building or the individual buildings housing the machine units, if the design calls for such buildings, are divided into two or three work areas depending on the availability of manpower and equipment. The construction and installation jobs are done in each work area in parallel with work being done by specialized production teams. The work of the latter is tied in and coordinated with previously written plans and timetables. Each specialized production team is given the required manpower and equipment, and the equipment is transferred from one production team to another as needed.

Construction time was reduced by using the organization and procedures of compressor station construction discussed above together with the modular method and new design concepts such as metallic pile foundations for machine units and metallic foundation mats beneath building frames, installation of utility lines on scaffolding and on the facades of compressor station buildings and so on.

There are significant advantages, over previously employed methods, to introducing the modular and the integral flow-line method coupled with the use of the "rough" floor method and pile foundations in compressor station construction. However, a number of negative phenomena arise in this process of compressor station erection as well, ones which have an unfavorable influence on organization and production, keep the construction rate low and reduce the production and labor discipline of builders and installers.

Improvements are needed in the system for delivering equipment, cabling and materials to the plants manufacturing module boxes. Module boxes are often delivered to the construction sites incomplete, and sometimes even totally empty. As a result the advantages of the modular method are reduced to nought.

A great deal of time and resources are expended on foundation work, especially at flooded construction sites. This makes it mandatory to cover the site in winter with filtering dirt--sand or a sand-gravel mixture from 0.6 to 1.5 meters thick.

Special emphasis should be laid on the important significance of integrated construction of compressor stations.

Unfortunately many construction organizations place their stations into operation without the housing facilities. Residential buildings and cultural and personal service facilities must be built by a separate production team and be made ready for operation simultaneously with the compressor station. The drafting of the planning documents must be organized, and the documents should be submitted to builders at the same time as the documents for the principal structures.

All utilities (water and heat supply, sewer systems, power supply and so on) must be connected to these facilities, and the modular structures produced by the Vinzili and Apsalyamovskiy house building combines should be worked into the plans.

Organization of Operational Planning and Control

If we are to raise the effectiveness of compressor station construction and the quality of the finished product, we would have to improve operational planning and control. The reason for this lies in the continual growth of the scale of compressor station construction, growing complexity of structures and interconnections, intensification of production processes, general scientific-technical, economic and organizational progress and the national economic significance of the final production goal--placing compressor stations into operation.

A certain amount of experience has been accumulated in organizing operational planning and control in erection of compressor stations on the most important gas pipelines, such as Vyngapur-Chelyabinsk, Urengoy-Chelyabinsk, Urengoy-Gryazovets-MOK, Urengoy-Petrovsk and Urengoy-Novopskov.

Operational planning and control follows a three-stage system (its elements are the directive construction schedule, the monthly planning schedule and the weekly-daily quotas), and it embraces all levels of the sector's management--from management of operations in the individual construction sections to the selection conferences conducted under the ministry's guidance.

An analysis of the state of operational planning and control in some subdivisions of the Minneftegazstroy revealed that the organization of operational control at the level of the construction section and the construction administration (mobile mechanized column) is the weakest link.

Operational control functions are often redundant, and as a rule they are carried out by the primary executives of the organizations, who deal with these problems to the detriment of long-range planning.

At higher levels (at the level of main territorial production administrations) specialists do not always participate in the development of quarterly schedules for construction of the most important facilities, particularly the priority compressor stations, they do not systematically monitor fulfillment of these schedules, they do not maintain control over introduction of monthly and daily-weekly planning, they do not subject the causes of quota failures to adequate analysis, and they do not submit proposals on ways to intensify the work so that compressor stations could be placed into operation by the directive deadlines, and with high quality.

A specific-purpose system of operational planning and control of construction of the Urengoy-Pomary-Uzhgorod gas pipeline has now been developed. Its purpose is to promote unconditional completion of construction and commissioning of the gas main and, in particular, the compressor stations within the established deadlines. The main functional unit of the specific-purpose system for controlling erection of the gas pipeline is operational planning and control. The system will be finalized and improved in the course of its introduction into construction practice.

A socialist competition for early commissioning of compressor stations under construction has been initiated between production collectives at the compressor station construction sites.

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FLOW-LINE METHODS USED TO ERECT COMPRESSOR STATIONS

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 83 pp 15-17

[Article by V. A. Aronov, Sibkomplektmontazh Association, Tyumen: "Compressor Stations on a Flow Line"]

[Text] The Sibkomplektmontazh Association is engaged in modular construction of petroleum and gas facilities, including compressor stations in Tyumen Oblast and a number of nearby oblasts. In 2 years of the 11th Five-Year Plan the association installed 30 compressor stations, and in the remaining 3 years it must make 74 compressor stations operational on the Urengoy-Novopskov, Urengoy-Pomary-Uzhgorod, Urengoy-Center gas pipelines.

Beginning with 1977 not only the compressor shops and the frame-and-panel buildings but also most auxiliary structures were planned and delivered to the construction sites in the form of completely prefabricated module boxes and production equipment modules. Use of the modular method made it possible to decrease the time of construction of compressor stations by almost 20 percent. In 1978 the association began the work of installing the pipelines and production equipment of the compressor stations.

Assignment of all construction and installation jobs to a single organization reduces the number of subcontracting subdivisions at a single construction site, which makes it easier for the general contractor to coordinate the work. Use of progressive procedures and new forms of labor organization is being promoted by the association's production structure, which allows for specialization of its subdivisionsin relation to different kinds of jobs.

Two enlarged brigades are sufficient to handle the entire complex of jobs associated with installing compressor stations equipped with GTK-10 units--one brigade of 60 persons to install the production equipment, and one consisting of 80-90 persons for the rest of the work. As a rule the production equipment is installed by brigades of the Komsomol Youth Administration No 1 headed by Yu. I. Kil'dyushov, Hero of Socialist Labor M. I. Buyanov and brigade leader L. A. Ashikhmin. These brigades install the external gas manifolds connecting the force pumps, the gas air cooling units and dust traps to the pipelines, the intershop pipelines, the oil system and so on.

The structural members of the compressor shop, the auxiliary service annexes and other frame-and-panel buildings, and the module boxes are installed by the brigades of PMMK-5 [not further identified], (V. K. Luk'yanov, N. D. Bodrov, A. N. Mal'kov), PMMK-2 (G. N. Medvedev), PMMK-3 (N. S. Ryazantsev) and others. The "low side" of compressor stations is installed at a number of facilities by the brigades of PMMK-5 and brigades from the KMMU-1 [Komsomol Youth Installation Administration No 1] headed by Lenin Prize laureate A. F. Shevkoplyas.

Concentration of construction and installation jobs at a single construction site (installation of the structural members of buildings, module boxes, pipelines and equipment) offers the following advantages to the construction organization: The number of relocations from one facility to another is reduced; the extent to which machines and mechanisms can be maneuvered rises; social and personal services to the working brigades improve. Periods of idleness due to the absence of work room are shortened, since a possibility appears for transferring installers to those sections which are the most prepared for work at the given time. Introduction of the flow-line construction method is thus assured.

The integral flow-line and the through flow-line methods are used in compressor station installation. In the integral flow-line method the jobs are distributed by type among units that form specialized production teams. The output capacity of the specialized production teams is determined on the basis of the prescribed duration of the work cycles and the optimum structure of the production units. Large facilities such as the compressor shop and the SVP [not further identified] are divided into individual work areas. Specialized production teams were organized in the following fashion for erection of compressor stations on the Urengoy-Petrovsk gas pipeline. The first production team: a unit installing the external manifolds of force pumps and manufacturing pipe fittings for all production pipelines; a unit installing pipe connections for dust traps, gas air cooling units and intershop pipelines; a unit installing dust traps, gas air coolers, pipelines carrying fuel and igniter gas along the shop, and gas separators. The second production team: a unit installing the SVP in the compressor shop (three units); a unit installing gas conduits, air ducts, regenerators and smokestacks; a unit installing module boxes and integrated air cleaners.

Each specialized production team is outfitted with the necessary manpower, materials, load lifting mechanisms and welding equipment. A scheduled tied in with the movements of the production team is drawn up for the movements of the load lifting mechanisms around the construction site. The total manning of the first production team is 60 persons, and that of the second is 90. The work cycle of a production team working at a particular facility is 5 months long.

The integral flow-line work method is undergoing constant improvement. While previously the gas conduits and air ducts had been connected to the turbo-unit after installation of the engine room, which created certain difficulties in using the bridge crane, now the connections are made by special cranes prior to installation of the shop structures. This produces a payoff in time and reduces the burden on the bridge crane.

Preparations for subsequent production operations are made well ahead of time. As an example the unit that installs the frame of the engine room also lays fuel and igniter gas piping on brackets in its planned positions. Later on, this piping is welded together by other installers. Simultaneously with installing the frame, the igniter plugs of the turbo-units are suspended. The "igniter plugs" of the force pumps are installed similarly during installation of the partition of the compressor shop.

The through flow-line method foresees organizing single enlarged production teams that proceed from one compressor station construction site to another along the gas pipeline, or from one phase of construction to another at the same site.

Specialized units similar to those described above function in each such production team. The duration of the work cycles of specialized production teams is determined, with a consideration for relocation time, in such a way that the team's units would move relative to one another at the new facility in the same way as at the previous facility.

The through flow-line method requires continuous planning 2 or several years into the future. The most convenient variant is one where several phases of construction proceed simultaneously at the same construction site. This is the case with construction of multistrand gas pipelines within a single corridor.

The association has written a statute on the production team leader. The production team leader is appointed by an order of the general director, and he is provided certain rights in resolving the problems he encounters. He manages the program for supporting preparations for construction and installation, and the program for installing and commissioning the complex of facilities erected by the given production team.

The association has accumulated experience in fast installation of compressor stations. Thus eight brigades grouped into two production teams worked on the Pripolyarnaya compressor station on the Urengoy-Petrovsk gas pipeline. In 6 weeks they installed the auxiliary service building, a compressor shop for six machines and the pipeline connections of the force pumps. The main jobs that had to be done before the gas pumping units could be started up were completed 3.5 months after installation was started.

The Bogandinskaya, Yarkovskaya and Tobol'skaya compressor stations on the Urengoy-Chelyabinsk II gas pipeline were erected at an accelerated rate. The production operations performed by different production teams were coordinated in time to the maximum extent. The specialized production teams were manned to the maximum (to the limit beyond which output per worker dropped). As a result the duration of the work cycles was decreased by a factor of 1.5-2.

Prompt and complete delivery of materials and equipment, anticipatory preparation of foundations and trenches and efficient work of mechanisims and equipment are prerequisites of using the high-speed integral flow-line method.

A greater degree of plant prefabrication of a facility is one of the components of faster construction. Besides module boxes and production equipment modules, the association's plants make service platforms, ladders and guard rails, doors, gates, window blocks and pipeline supports (sliding and permanent) and other items for the installing subdivisions. Pipe units were ordered from and manufactured by the Novosineglazovskiy Construction Structures and Parts Combine Komsomol'skaya and Uzyum-Yugan compressor stations on the Urengoy-Novopskov gas pipeline.

Installation of structural members that are first put together into larger blocks is being performed with the purpose of raising labor productivity and reducing the volume of construction work. Column blocks or wall blocks (consisting of metallic structures and panels) are assembled on a stand in an assembly site, and then, supported by crosspieces they are lifted by installation cranes to their intended positions. Pipe units weighing as much as 65 tons are assembled at another site. Preliminary assembly and enlargement of the pipeline units makes it possible to begin installation operations before the foundations are completed, which in the final analysis reduces construction time.

The association has developed standard outfits of equipment for installation brigades working on compressor stations, with a consideration for their specialization.

Mechanization of vertical movement of workers during erection of compressor station buildings represents a significant reserve for reducing losses of working time. This would require truck-mounted hydraulic elevators with an elongated hinged boom.

The Orgtekhstroy trust has developed procedures for installing compressor stations with the help of truck-mounted hydraulic elevators. In it, most of the steeplejack jobs associated with installing metallic structures, enclosing structures, equipment pipe connections and so on are mechanized.

The association is receiving limited quantities of jacks, winches and other small mechanized tools.

Compressor stations are being built by the watch and the expeditionary watch methods. In this case the mobile brigades of the KMMU-1, which is based in Tyumen, work by the expeditionary watch method, while the brigades of the rest of the subdivisions work by the watch or expeditionary watch method.

The expeditionary watch method entails interregional use of manpower and other production resources, while the watch method entails intraregional use of manpower and regular rotation of the workers.

Both methods foresee long work days during construction and installation of a facility (during the watch period) and subsequent compensation with time off at permanent places of residence. In this case the working time of a particular period of accounting does not exceed that approved by law. The duration of work time in a watch and the length of a work week are limited by the production conditions and primarily by medical considerations, while the amount of

time off at home depends on the length of the work period and on the amount the standard for working time is exceeded each week. Experience has shown that the following schedule is the most acceptable for watch brigades of the sibkomplektmontazh association: 23-24 days of work and 6-7 days off. Just prior to the commissioning of a facility the work period of a watch may lengthen to 2 months, after which a corresponding amount of time off is provided.

In other sectors, after a collective of workers (drillers, foresters) completes its watch, it is replaced in its entirety. In the association's watch brigades, the time off is determined on the basis of a sliding schedule. This schedule is drawn up by the foreman and brigade leader, and it is coordinated with the brigade members.

The enlarged installation brigade consists of units in which some of the workers are versed in two or more associated occupations. This makes it possible to release from one to three persons of a unit for time off in accordance with the schedule without detriment to production. Continuity of construction is insured in this way. The same brigade works for several months without a break on a particular facility, but all of the workers are able to take time off at home several times during this period.

The "Watch" integrated specific-purpose program has been developed in the association. It foresees a complex of organizational, economic, social and ideological measures.

A plan of ideological work with labor collectives has been drawn up and is now being implemented in conjunction with construction of the Sos'va, Komsomol'skaya, Pelym and Uzyum-Yugan compressor stations. The association's party committee encourages the participation of the party organizations of the subdivisions and the association's social organizations in this work, and it establishes contacts with territorial party organs. This permits the scheduling of more lectures and concerts. A "labor glory night" and performances by agitation brigades were organized at the palaces of culture of the towns of Sovetskiy and Komsomol'skiy. Agitation tours from Tyumen by lecturers from the primary organization of the "Znaniye" Society and by the "Montazhnik" agitation brigade, sports holidays, book sales and meetings to summarize competition results have become highly popular among the installers.

But the successes of the association's collective in construction of compressor stations could have been even greater. The general contractor does not always prepare the work area in time, meaning that installation brigades must wait for work or be relocated to other facilities, after which a crash campaign must be waged to make up lost time. Sometimes clients fail to meet the equipment delivery deadlines, and delays in providing planning and estimate documents still occur frequently.

Plans differing significantly in relation to the layout of compressor shops and auxiliary service buildings have been produced by the YuzhNIIgiprogaz and Giprospetsgaz [not further identified] institutes for compressor stations equipped with GTK-10 pumping units on the Urengoy-Gryazovets and Urengoy-Petrovsk gas pipelines. The layouts of shops intended for eight machine units

differ: 5+3 and 6+2; the decisions on where to locate ventilation chambers and the pipe connectors of the machine units differ. The same can be said for the oil air coolers. While the layout of the machines in compressor stations on the Urengoy-Novopskov gas pipeline is the same, 6+2, the lengths of the compressor shops differ, as do the sizes of the auxiliary service buildings and the pipe connections of the machine units.

In its plans for compressor stations being built in Tyumen Oblast and supporting the Urengoy-Pomary-Uzhgorod export gas pipeline, the YuzhNIIgiprogaz institute foresaw the use of module boxes in structures designed by the Experimental Design Office for Reinforced Concrete, which the association does not manufacture, even though during the preplanning stage this institute had reached an agreement with the association to use module boxes in structures that have been assimilated by our plants.

New types of compressor stations are to be assimilated in the future. The association is making organizational and technical preparations for installing compressor stations equipped with GPA-Ts10 and GPA-25 gas pumping units, and it is making preparations to implement the measures of a program for assimilating industrial production of fully prefabricated outfits of structures for compressor stations equipped with GTN-16 and GTN-25 pumping units.

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WORK METHODS FOR TYUMEN COMPRESSOR STATION CONSTRUCTION DESCRIBED

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 83 pp 17-19

[Article by B. V. Shpak, Severgazstroy trust, Nadym: "Erection of Compressor Stations in the Tyumen North"]

[Text] The Severgazstroy trust, which was organized as an urban construction trust with the main objective of erecting residential buildings and cultural and personal facilities in Nadym, was given a new outlet for its activities in 1974--construction of compressor stations. At that time the trust was assigned the erection of two compressor stations--in Nadym and in Pangody, located far away from the city.

The new tasks required the trust executives and the party, Komsomol and trade union organizations to reexamine the manpower distribution in the production control system in relation to the large amount of work that had to be done on industrial facilities located far away from the permanent homes of the workers, the bases and so on.

The hardest thing to do was to change the habit, picked up by people over many years, of working and living in the city. There was much for the party and Komsomol organizations of the trust and the administrations to do in this area. The desired result was attained. Good collectives capable of completing great and complex tasks came into being.

Erection of the compressor station at Nadym was assigned to the Komsomol youth Construction and Installation Administration No 3 and construction of the compressor station in Pangody was assigned to Specialized Administration No 41.

Because the work volume increased with every year, the trust was able to significantly improve labor organization and accumulate a certain amount of experience that has been utilized successfully in recent years in the development of the Urengoy gas deposit.

In 1980-1982 four compressor stations with a total output capacity of 320,000 kw were built and placed into operation.

The experience of building compressor stations in the conditions of the Far North confirmed the real possibilities for reducing the time to erect the station by a factor of two and more.

Life itself suggested the reserves for this.

First of all, organization of weekly-daily planning and strict control over fulfillment of daily quotas have important significance. Organizing a staff for operational management of the construction project produces a significant impact.

Operational meetings held twice a day--at 0900 and 1900 hours--make it possible to arrive at immediate decisions concerned with eliminating any problems that may arise and efficiently organizing the work for a period of several days.

Weekly selection conferences conducted by the ministry with the participation of the client's representatives raise the sense of responsibility and encourage better work on the part of not only the contracting organizations but also the client's subdivisions. This is important because the work indicators of all subdivisions depend to a great degree on how efficiently the client delivers equipment. To make the administrations more independent, the trust basically prescribes only the final deadline for finishing construction and provides a general work schedule coordinated with Glavurengoygazstroy [not further identified] and approved by the ministry. The right of weekly and daily planning is delegated to the administrations. Experience has shown that the administrations are able to keep within 90 percent of the deadlines specified by the weekly-daily construction schedule.

Much attention is being devoted to raising the role of the general contractor in the overall progress of construction, and increasing his responsibility for preparing the work area for subcontracting subdivisions. Conditions are created permitting maximum integration of the work of different subcontractors.

Meticulous engineering preparation for construction is a major reserve for reducing compressor station construction time. Thus because external utility lines and shop underground supply lines had not been completely laid and because the concrete floor slabs had not been poured by the time installation of the compressor shop and the auxiliary service annex was started at the Nadym compressor station on the Urengoy-Petrovsk gas pipeline, significant difficulties arose in the period of intensive work associated with connecting the turbo-units, applying thermal insulation to them and making the preparations to pump oil through. It was extremely difficult to pour the concrete floors because there was so little room in the shop and because the concentration of workers was at its maximum. As a result preparations of the turbo-units for final adjustments had be to be delayed 2-3 days.

These shortcomings were accounted for in the construction performed at the same compressor station for the Urengoy-Novopskov gas pipeline. By the time installation of the shop and the auxiliary service annex began, all of the underground supply lines and the concrete floors had been completed, making it possible for derrick cranes to position large pieces of the gas ducts, air

conduits and other connecting parts at their places of installation prior to installation of the roof.

Use of the bridge crane was improved and labor safety was insured in this way.

Because the ministry has adopted the policy of commissioning the shops of a compressor station separately, the trust now organizes its work in the following way: Two overhead traveling cranes and two single-rail overhead traveling cranes are installed in the force pump gallery and placed into temporary operation during installation of the turbo-units and their connection and thermal insulation in the engine room. Given a sufficient number of specialized installers, this permits work on two or three turbo-units simultaneously (inspection, thermal insulation, installation etc.).

Prior to construction of compressor stations for the Urengoy-Petrovsk gas pipeline, metallic foundation mats beneath the building frame, regenerators, smokestacks and the "gitara" [translation unknown] were made by installer brigades right at the construction site. In 1980 a khozraschet small mechanized tool section began manufacturing metallic foundation mats of all types, supports for tubo-units, anchor bolts and other articles that are now delivered to the compressor station site painted and marked. As a result the labor-intensiveness of the work has decreased and its quality has improved.

It was established with test piles during construction of the Nadym compressor station that their actual carrying capacity is 25 percent higher than planned. Pile length was decreased from 8 to 6 meters with the approval of the YuzhNIIgiprogaz institute. This resulted in a savings of 500 meters of 325 mm diameter piping and a 23 percent reduction of labor outlays. To reduce the volume of excavating operations, a decision was made to lay the cable network not in a trench but on scaffolding. The labor-intensiveness of the work decreased by 26 man-days, and the conditions for using the cable networks improved. This method of laying cable networks was approved by the Scientific Council of USSR Gosstroy and recommended for further dissemination.

Change in the design of the air intake chamber, which was grouped together with the oil cooler, made it possible to significantly reduce installation time and produced an economic impact of about 170,000 rubles.

Underground heat supply lines were moved from the outside of the shop in the crowded conditions on the low side to inside the shop on support brackets mounted on columns. As a result a significant amount of excavating, the laying of supporting troughs and pipe thermal insulation jobs were excluded. The decrease in labor outlays was 293 man-days.

On a proposal from the builders, all of the supports for equipment inside the shop are now being made from metallic piles. As a result there is no longer any need to pour monolithic reinforced concrete foundations beneath the supports, and consequently concrete foundations no longer have to be poured in winter. The labor outlays decreased by 93 man-days. Piles to support equipment are driven simultaneously with piles for the shop frame.

Great difficulties arose due to the continual shortage of crushed rock. Use of sand-concrete mixture for industrial buildings and structures was not foreseen by any of the documents. The requirements of the VSN 2-116-79 applied only to public, cultural and personal service buildings.

The Severgazstroy trust turned to the Scientific Research Institute of Concrete and Reinforced Concrete with a request to examine the possibility of using sand-concrete mixture in industrial structures, and particularly in structures experiencing dynamic loads. After a series of experiments produced positive results, the institute recommended sand-concrete mixture for foundations for GTK-10-4 turbo-units and force pumps. As a result of its introduction, the trust achieved a savings of about 2 million rubles in just the 10th Five-Year Plan.

Following several appeals from the trust, the planning institute agreed to exclude overhead traveling cranes from the service area, leaving only staircase-equipped landings with 1 × 1.2 meter dimensions. This decision is expedient because an overhead traveling crane must also have its own service platform. Introduction of this concept into the Nadym and Pangody compressor stations saved 4.5 tons of metal at each station.

The trust used a fireproof coating on metallic structures for the first time at Pangody Compressor Station No 2 on the Urengoy-Petrovsk gas pipeline. It is difficult to overstate the importance of using this material. The need for lining the columns of the building frame with brick, followed by plastering and painting, was eliminated. Before, moreover, these jobs had to be done during installation of the equipment in the shop and in the presence of an operating overhead traveling crane as a rule. The reduction of labor outlays exceeded 330 man-days. Replacement of sovelite and perlite-cement slabs by basalt superthin fiber as thermal insulation for combustion chambers, gas ducts and air conduits passing within the shop will produce a significant economic impact in the future. At the moment the thickness of the heat-insulating layer is 240 mm, and it takes a great deal of labor to apply it. After basalt superthin fiber is introduced, the thickness of the insulation will decrease by 100 mm, its weight will drop sevenfold, and the labor-intensiveness will decrease tenfold (owing to the use of pierced matting). The economic impact for one compressor station is tentatively estimated at about 50,000 rubles.

Significantly, use of basalt superthin fiber will reduce work time.

The trust's engineers and technicians are continuing their search for new concepts that would reduce labor-intensiveness, decrease work time and raise the quality and effectiveness of compressor station construction (figures 1, 2, 3 [not reproduced]).

The party committee, the Komsomol committee and the association trade union committee are doing a great deal of work to mobilize the builder collectives for early commissioning of the facilities.

To raise the effectiveness of construction, unofficial party and Komsomol construction project organizations have been created. Such a Komsomol organization did good work from "Komsomol Searchlight" posts during erection of the Nadym compressor station. During the period of the most intense work, "searchlight operators" monitored the work progress around the clock, and they prevented failures of quotas set at operational meetings. The best workers were singled out and those lagging behind were criticized in flash bulletins. On occasion this helped more than critiques held in planning meetings.

The signing of contracts for socialist competition became a regular practice. Conducted according to the "workers' relay" principle, these competitions were run between the trust and the Nadym LPU [not further identified]--the organization that was to accept the compressor station for operation. This measure had a positive result in that the workers of the operating organization now work together with the installers and process engineers when preparing the turbo-units for testing and starting, rather than waiting around for the inspectors.

The specific terms of socialist competition between the brigades are being written at each compressor station. The main indicator is fulfillment of production quotas in accordance with the work schedule.

The winning collectives of the socialist competition are awarded Red Banners, honorary certificates and money prizes. The total amount of prizes received by the best workers in 1 year is up to 800 rubles.

The following steps must be taken to raise the effectiveness of compressor station construction.

Delivery of modules to Nadym or to another base during the sailing season and their prompt delivery to the construction site must be organized more efficiently.

Construction and installation jobs could be completed more quickly if the client would deliver all of the required equipment, valve fittings and connecting parts to the construction site before the time set for their installation. All of this equipment must be accompanied by log books, certificates and other required documents.

In my opinion it would be a good idea to amend the plans to include lighter service platforms for the "gitary", the gas air coolers, the dust traps and so on.

To simplify the connections of compressor station gas pipelines, two-stage gas force pumps generating an exit pressure of 7.5 MPa should be introduced.

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WAYS OF REDUCING MANUAL LABOR SOUGHT

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 82 pp 22-23

[Article by V. Ye. Lapshin, Glavneftegazstroymekhanizatsiya: "Reduction of Manual Labor in Erection of Compressor and Pumping Stations"]

[Text] In 2 years of the 11th Five-Year Plan the quantity of construction machinery and small mechanized tools available to organizations of the Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] increased significantly. The power-to-worker ratio increased in the sector from 28.3 to 34.5 kw per worker.

The work completed in 1982 included 740 million m^3 of earth-moving operations, loading and unloading of 98 million tons of construction freight, installation of 9.5 million tons of structures, 1.2 million m^3 of concrete laying, 7.5 million m^2 of plastering and 20 million m^2 of painting.

Measures implemented to achieve fuller mechanization and automation of construction made it possible to achieve the following reductions in the volume of manual labor in 1982 as compared to 1980 (calculated per million rubles of construction and installation): Excavating jobs--6 percent; freight handling--9 percent; concrete laying--15 percent; finishing jobs--5 percent.

Comparing the data of censuses taken by the USSR State Statistical Administration, the percentage of manual laborers in our sector decreased from 58.6 percent on 1 August 1979 to 55.1 percent on 1 August 1982. This includes a decrease from 63.7 to 62.1 percent for general construction work, from 37.8 to 30.3 percent for pipeline work and from 70.8 to 60.7 percent for erection of compressor and pumping stations.

The level of manual labor in the ministry's organizations continues to be high.

Manual labor represents 27.3 percent in excavating operations, 58.4 percent in installation of reinforced concrete and steel structures, 72.0 percent in concrete laying operations, 76.2 percent in painting and plastering jobs, 95.7 percent in masonry jobs and 83.4 percent in carpentry and joinery.

As a result of growth in job industrialization (modular construction), full mechanization of construction (reequipment of the sector) and improvement of the organization of construction, labor and control (improvement of the structure of construction), in 2 years of the 11th Five-Year Plan labor productivity increased by 11.4 percent, which was equivalent to freeing about 8,000 workers. While growth in the volume of construction and installation was 26 percent in these years, the total number of workers involved in construction and installation increased by only 5.4 percent.

Significant reserves for reducing manual labor can be found in all construction organizations and industrial enterprises, and in relation to all kinds of jobs performed in the sector.

The main directions and measures for reducing manual labor in construction were reflected in the 1983-1985 production program drawn up by the NIPIorgneftegazstroy [not further identified] institute jointly with the Glavneftegazstroymekhanizatsiya [not further identified], the Main Technical Administration and the Administration for Organization of Labor and Wages. This program foresees an increase in the level of industrialization of construction, work mechanization and automation, and improvement of construction.

A higher level of industrialization will be achieved in general construction and in construction of compressor stations owing to implementation of the following measures:

Measure	1983	1984	1985
Expanded introduction of module boxes	6300	9400	11,200
Use of quickly erectable type SKZ buildings	2225	2300	300

These measures will make it possible to eliminate the manual labor of more than 4,000 workers.

Growth in mechanization and development of full mechanization and automation of the principal construction and installation jobs will be insured by:

Measure	1983	1984	1985
Supplying mechanized tools, hand tools and finishing machines for above-ground construction, million rubles	8.0	11.6	14.0
Producing automated concrete mixture and mortar preparing units with a productivity of 30 m^3/hr	5	15	25
Making up standard kits of tools for general construction jobs	200	250	300
Producing a complex of machinery for mechanized roofing installation	40	50	60

By raising the level of mechanization and automation, we will eliminate the manual labor of over 4,000 workers.

Improvements in work procedures and in the organization of construction and labor will be promoted by:

Measure	1983	1984	1985
Increasing the proportion of jobs completed by the brigade contract method, percent of the total volume of construction and installation jobs	47	54	55
Raising the proportion of shipments performed by the brigade contract method	20	24	27
Introducing technically grounded norms and standards by which to standardize the labor of construction workers, 1,000 persons	14.7	22.5	25

Four small-scale mechanization administrations and 20 sections will be created. All of this will make it possible to free another 5,860 workers doing manual labor.

In 1983-1985 the decrease in the number of workers involved in manual operations will be 8.7 percent of the total number of workers.

A significant decrease in the number of workers doing manual labor has been foreseen in relation to the following types of jobs:

in excavating jobs, 30 percent, basically due to a decrease in the volume of excavating jobs involved in the construction of compressor and pumping stations and other structures, use of an industrial method for laying utility lines, and introduction of excavators outfitted with smoothing equipment and hydraulic hammers, and various types of mechanical tampers;

in concrete laying operations, 40 percent, due to introduction of automated concrete mixers, unified dismantleable and moveable large-panel forms, moveable automated electric concrete warming units, machinery to smooth out concrete floors and so on;

in plastering jobs, 18 percent, due to expanded use of moveable plastering stations, use of effective industrial structures to include large-panel gypsum-concrete partitions and higher-quality hollow drywall partitions, provision of standard tool kits to the brigade etc.;

in painting jobs, 17 percent, due to broader introduction of painting stations, priming units equipped with screw-driven cartridge pumps, high-pressure airless paint sprayers, electrostatic painters and other hand tools;

in installation jobs, 15 percent, due to broad use of modular units and prefabricated structures, a greater degree of their plant prefabrication, use of derrick cranes with a higher lifting capacity and provision of hand tools.

In order to raise labor productivity and reduce the volume of manual labor, which is especially important under the existing demographic conditions, the Minneftegazstroy and the Presidium of the Central Committee of the Trade Union of Workers in Petroleum and Gas Industry adopted a decision to develop a specific-purpose integrated program for reducing the use of manual labor in the construction of petroleum and gas industry enterprises in the period to the year 2000. Further growth in industrialization level, mechanization and automation, the use of robots and manipulators and improvement of the organization and procedures of construction and installation have been foreseen.

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WAYS OF REDUCING LABOR-INTENSIVENESS OF INSTALLING MODULAR COMPRESSOR STATIONS

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 82 pp 23-24

[Article by R. A. Tamer'yan, Glavneftegazmontazh: "Ways of Reducing Labor-Intensiveness of Installing Modular Compressor Stations"]

[Text] Organizations of the Glavneftegazmontazh [not further identifed] install power production equipment and production pipelines of compressor stations. Because of the accelerated development of the sector in the 11th Five-Year Plan, the traditional installation methods used at compressor stations are now imperfect. The Glavneftegazmontazh is making an effort to unify the planning concepts associated with the production sections of compressor stations equipped with different types of gas pumping units, and to industrialize installation work.

Jointly with the Main Technical Administration of the Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] and the planning institutes of the Mingazprom [Ministry of Gas Industry], it has developed a standard plan for compressor stations equipped with a GPU-10 gas pumping unit. The planning institutes that will develop the unified plans for compressor stations equipped with other types of gas pumping units have been determined. For example Giprospetsgaz [not further identified] is developing unified plans for compressor stations equipped with GTN-25 units, YuzhNIIgiprogaz [not further identified] is drawing up plans in relation to GTN-16 units, and VNIPIgazdobycha [not further identified] is drawing up plans in relation to GPA-Ts-16 units.

Unified plans will make it possible to sharply reduce the nomenclature of the pipes and pipeline connectors employed, to develop unified technical documents on connecting pipelines and to organize series production at bases belonging to subdivisions of the main administration and under plant conditions. Unification of the plans will make it possible to create a standard outfit of mechanisms and construction equipment to be supplied to the installation sections, and to stabilize and specialize the installer brigades.

However, some of the unified planning concepts associated with the production sections of compressor stations had not been coordinated with the installation organizations, and they require some correction. Thus the unified plan developed by VNIPIgazdobycha for compressor stations equipped with the GPA-Ts-16 did not

account for the unique conditions under which installation must proceed: Allowances must be foreseen in the connecting pipelines, so that they could be fit to force pumps and other equipment.

Planning organizations of the Mingazprom must finish their work of unifying the planning concepts for the production section of compressor stations.

The labor-intensiveness of installation can be reduced significantly by having a larger part of the work done at production bases of subdivisions of the Glavneftegazmontazh rather than at the installation sites. Production of module boxes for compressor stations has been organized in Belousovo, Kaluga Oblast and in Kagan, Uzbek SSR. However, their work pace is irregular because of delays in delivery of equipment by the client and delivery of enclosing structures by enterprises of the Soyuzstroymetallokonstruktsiya association. Thus the module boxes come to the compressor station construction sites empty, and the equipment must then be fitted in them at the installation site. Earlier, Belousovo had produced module boxes for pumping stations that were 100 percent ready. Module boxes for pressure regulators, shock wave dampers, circulating pumps, fire pumps and air compressors were sent to the installation site with the monitoring and measuring instruments, automatic equipment, electric equipment and other items already installed. Thus all that was left to do at the site of the pumping station was to place the module on its foundation and connect it to the supply lines. In order to reduce the labor-intensiveness of installing modular compressor stations today, we would need to fundamentally alter the equipment supply system.

Improvements are also required in the planning and design concepts. There are a number of shortcomings in the honeycomb system used to build the control rooms and the service and repair blocks of compressor stations. Doubled and tripled module boxes must be planned in such a way that the amount of assembly of the structural part of the equipment and the production pipeline at the installation site would be minimized. The nomenclature of module boxes produced by the Mingazprom and the Minneftegazstroy must be clearly indicated.

Installation of production pipelines is the most laborious operation performed at a compressor station construction site. The Glavneftegazmontazh decided to transfer the manufacture of a large proportion of the production pipelines from the production bases of the main administration's subdivisions to the Novosineglazovskiy Construction Structures and Parts Combine. Piping units with a diameter of up to 1,020 mm intended for compressor stations equipped with different types of gas pumping units are now being manufactured at production bases on the basis of unified drawings developed by the main administration. Thus the number of joints on gas connectors for force pumps that are welded at the plant averages 344, while the number welded at the installation site averages 162. The corresponding figures for dust traps are 22 and 4, and for the air coolers the figures are 37 and 25. Thus 65 percent of all welded joints are made at the plant. This makes it possible to reduce the number of qualified welders needed for work at the installation sites, to raise the quality of assembly jobs involving welding and to achieve an economic impact on the order of 100 rubles per ton of manufactured pipe units.

The demand for pipe units for compressor stations is constantly growing. The pipe unit shop of the Novosineglazovskiy Construction Structures and Parts Combine, which must supply pipe units to compressor stations located in West Siberia, must be reconstructed.

Reconstruction of the production base belonging to the Tsentrkomplektmontazh trust is to begin this year. Manufacture of about 2,000 tons of pipe units per year with a diameter of up to 700 mm will be concentrated at the base, located in Belousovo, Kaluga Oblast. Construction of a production base for the Urengoygazmontazh trust will begin. It will have a shop producing pipe units with a diameter of up to 720 mm at a rate of 1,200 tons per year. Commissioning of this shop will make it possible to significantly increase pipe unit production.

There are difficulties in delivering pipe units to installation sites, especially in West Siberia, in the absence of roads open year-round. A clear monthly program for manufacturing pipe units is required. The transportation services to be used in their delivery must be determined, and the units must be shipped to the consumer strictly according to the developed program.

Much attention should be devoted to developing the methods of transporting oversized pipe units with pipe fittings already installed, and to the ways of transporting type UB-12 module boxes without the need for additional freight handling equipment.

Broader introduction of automatic welding and of high-productivity resources for checking the quality of welded joints will make it possible to reduce the labor-intensiveness of installation operations. Jointly with the Institute of Arc Welding imeni Ye. O. Paton, the Kiev affiliate of the "Gazstroymashina" Special Design Office has developed and tested the mobile "Styk-2" complex for welding pipes with a diameter of 530-1,020 mm using powder-filled wire. Tests showed that welding productivity is 1.5-2 times higher with this complex than with hand welding. Introduction of such effective mechanisims must be accelerated.

If the labor-intensiveness of installing modular compressor stations is to be reduced, it would be very important for the modules of gas pumping units delivered to compressor station construction sites to exhibit a high degree of completeness, so that a significant volume of installation jobs would not be required at the installation site.

Implementation of the measures suggested above will promote a further increase in the effectiveness of construction of compressor stations on gas mains.

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MEASURES PROPOSED FOR REDUCING COMPRESSOR STATION CONSTRUCTION TIME

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 83 pp 24-25

[Article by A. S. Aberkov, Glavneftegazmontazh: "Possibilities for Reducing Compressor Station Construction Time"]

[Text] About 240 compressor stations are to be built on gas mains in the 11th Five-Year Plan. The principal gas mains will be laid within a single power system corridor. This will create a possibility for erecting compressor stations for different gas pipelines at the same construction site. A number of problems which had not played a significant role in the erection of lone compressor stations will have to be solved.

Analysis of the planning concepts for the production sections of compressor stations on the Urengoy-Chelyabinsk-Petrovsk and the Urengoy-Gryazovets gas pipelines showed that institutes of the Ministry of Gas Industry have not yet arrived at common decisions on the design of connecting pipelines and individual production areas. Thus the Giprospetsgaz [not further identified] Institute drew up plans in which eight gas turbine units are located in two shops (correspondingly 6 and 2) for the Urengoy-Gryazovets pipeline, while the YuzhNIIgiprogaz and VNIPItransgaz [not further identified] institutes adopted a 5-3 arrangement of machine units for similar compressor stations on the Urengoy-Chelyabinsk-Petrovsk gas pipeline.

Despite the fact that unification was decided upon, each institute had drawn up its own plans for the connecting piplines of dust traps, condensate collecting pipelines and gas inlet and outlet manifolds.

The gas connecting pipes of the force pumps of some compressor stations are planned with small starting loops equipped with Z "bis" valves. One institute planned manifold manholes opening inward, while the other planned them opening outward; the sliding supports of pipelines have been planned with fluoroplastic linings and without them. Things are the same with the gas cooler installation sites.

Absence of unification is resulting in a proliferation of the nomenclature of pipes and connecting parts, and it is an obstacle to organizing the production of pipe units and intermediate products.

According to data of the NIPIorgneftegazstroy [not further identified] the total labor-intensiveness of construction of a compressor station equipped with five pumping units is 142,400 man-days; this includes 22,000-25,000 man-days for installation of production equipment and pipelines.

Despite the work that is being done by the machine building plants and by the operating, construction and installation organizations, the labor-intensiveness of installation work continues to be significant in the construction of compressor stations.

N-370-18-1 and N-235 force pumps, which are driven by GTK-10-4 and GPU-10 gas turbine units and synchronous triphasal STD-12500 and STD-4000-2 motors, are now the most widely used in compressor stations servicing gas mains. Gas turbine units with GPA-Ts-6.3 aircraft drive units are widely employed. All units except for the STD-4000-2 are delivered in modular form, though the extent to which the modular design is employed varies.

The GTK-10-4 unit is the least developed in modular design. This increases the labor-intensiveness of its installation. Thus it takes 25-30 installers to install eight GTK-10-4 gas turbine units within the established time, it takes 10-15 persons to install GPU-10 units, and it takes 7-10 persons to install the GPA-Ts-6.3 units.

The most complex operation associated with installing the GTK-10-4, representing 40-50 percent of the entire labor-intensiveness, is the manufacture, cleaning and installation of the lubricating systems, and sealing and adjusting the gas pumping unit.

Were the involved pipelines to be manufactured by the plants supplying the gas turbine units, the labor-intensiveness of their installation could be reduced by 65-70 percent.

The labor outlays on installation of equipment on the "low side" of a compressor station equipped with GTK-10-4 gas turbine units are sizeable. A third of these outlays involve putting parts together into larger units at the installation site.

One of the operations that influences the time it takes to commission a compressor station is the hydraulic tests that must be run on compressed gas pipelines. The design of the force pump body should be changed to permit a reduction of the testing time. Today, pressure-testing of the pipelines requires dismantling of the force pump to permit installation of plugs. It would be suitable to foresee flange connections in the body structure to permit attachment of pipelines to the compressed gas inlets and outlets.

Higher quality of the equipment delivered can have a noticeable influence, reducing the labor-intensiveness of installation jobs. Faulty castings and violations of the specifications for transport and storage of equipment are impermissible, since this can make reinspection of gas pumping units necessary.

The manufacturing plants should be very careful in selecting the brands of steels to be used for the oil lines, with a consideration for the actual conditions under which they are to be manufactured and assembled at the installation site. Thus some oil lines of the force pump's lubricating system are delivered for GPU-10 gas turbine units as stainless steel pipes, manufacture of which requires argon-arc welding, which is difficult to organize at an installation site.

It is very important for pipeline connecting parts (branches for the most part) delivered to compressor station installation sites to be devoid of deviations from the roundness requirements established by state and all-union state standards, inasmuch as sizeable labor outlays are required to correct them at an installation site.

Use of special external hydraulic centering guides will make it possible to raise the productivity of welding operations during installation of connecting pipelines with a diameter of 1,020 mm, and to improve their quality.

The nomenclature of pipeline connecting parts presently being produced influences the quality of installation and its labor-intensiveness. Because this nomenclature is limited, installers must sometimes join elements differing in thickness (by more than 3 mm), which is prohibited by the construction norms and regulations. Moreover each case of such welding must be coordinated with the planning organization, the scientific research institute and the client.

Complications arise in the hydraulic testing of production pipelines owing to differences in the requirements spelled out by the standards.

Construction Norms and Regulations III-42-80 foresees strength testing of category "V" pipelines, which include compressor station pipelines, at a pressure equivalent to nine-tenths of the yield point of the pipe material for 24 hours, and tightness testing at a pressure equal to the working pressure for 12 hours. Now the need has arisen for conducting strength tests at a pressure of 12 MPa. But the pipeline fittings and equipment continue to be tested by the manufacturing plants at a pressure of 9.4 MPa.

The standards must be brought into correspondence with the real conditions. This pertains especially to the testing of compressor station pipelines in winter, which is not regulated.

Despite the great experience that has been accumulated in installing production and power equipment and production pipelines, the scientific basis for improving compressor station erection procedures is insufficiently developed.

The NIPIorgneftegazstroy has a small group responsible for development of work plans for installation organizations. It is capable of producing three or four plans per year. The work plans being used by the installation organizations do not satisfy the present requirements. This is why manual arc welding is still encountered in compressor station installation, while automatic welding methods are being broadly introduced at other kinds of facilities.

A special production planning association must be created to develop the procedures of installing and welding the above-ground facilities of gas mains, to analyze the practical activities of construction organizations, to develop and introduce new mechanisims, welding equipment and mechanized tools and to develop the standards. In this case a single brigade could make all the preparations for erection of a facility: It can place orders for materials, manufacture pipe units, deliver modular units, provide mechanisims and small mechanized tools to the facility, accept the foundation work of the construction organization and perform the installation jobs.

Such a brigade must consist of 100-110 persons, including 15 engineers and technicians. As the work is completed, preparations for construction of a new facility could be started.

Thus unification of the plans for the production section of compressor stations, improvement of the quality of the equipment, fittings and pipeline connecting parts supplied, introduction of automatic welding of connecting pipelines, organization of existing standards and development of new ones on installation of compressor station equipment and pipelines, and introduction of the brigade contract and the watch work method together with progressive installation techniques will all make it possible to significantly raise the productivity of installation work in the construction of compressor stations, and insure completion of such work within 4-5 months.

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MORE SUPPORT NEEDED FOR ELECTRICAL INSTALLATION JOBS AT COMPRESSOR STATIONS

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 3, Mar 83 pp 26-27

[Article by N. I. Sidskiy, Glavneftegazelektrospetsstroy: "Special Installation Jobs at Compressor Stations"]

[Text] Subdivisions of the Glavneftegazelektrospetsstroy [not further identified] install the electrical equipment, the automatic systems and internal communication systems of practically all compressor stations erected by the Ministry of Construction of Petroleum and Gas Industry Enterprises.

It does most of its work in the concluding period of construction. This circumstance as well as various delays in providing the work room and in delivery of equipment and materials by the client result in the fact that not more than 1-2 months remain for the completion of special installation jobs; moreover, this is the period of the most intense work associated with preparing the station for start-up, when a maximum number of people and all of the load-lifting mechanisims are at work at the construction site, when access to working places is limited and so on. Under these conditions the role of qualified preparation for work, the qualifications and the political maturity of laborers, engineers and technicians, socialist competition and progressive labor organization rises especially.

Maximum transfer of work from the installation site to the production bases is an important way of increasing labor productivity. Among the organizations of Glavneftegazelektrospetsstroy the No 4, 7, 8 and 10 and Oktyabr'skoye installation administrations and organizations of the Gazmontazhavtomatika trust have achieved the greatest successes in preparing for production and in industrializing installation work. The work preparation groups of these subdivisions develop, as part of their work plans, the nomenclature of the materials and articles required for installation of the special equipment of compressor stations. Not later than 1 month prior to the start of work, everything required is delivered to the facility in full. Nonstandard metallic structures (light fixture brackets, pipe and cable conduits, attachment hardware for starting and adjusting apparatus, for monitoring and measuring instruments and for sensors, etc.) are manufactured in installation preparation sections. Over 1,000 structures and blocks of various types, fully equipped with instruments and completely connected to impulse and electric power lines, were manufactured in 1981-1982 just by Construction Administration No 6 of the Gazmontazhavtomatika trust.

Bases of this sort have also been created at other enterprises of the Gazmontazhavtomatika trust and the No 4, 10 and 17 and the Oktyabr'skoye and Neftekamskoye installation administrations. The Gazmontazhavtomatika trust has completely provided its installation administrations with practically all of the installation articles, units and intermediate products, small mechanized tools and instruments they need, all manufactured by the trust's owned subdivisions. The trust has a high zinc-plating output capacity, making it possible to apply a high-quality anticorrosion coating on all installation articles produced. Sixteen elevator-type warehouses were manufactured in 1981-1982 to improve the work of the supply system and to mechanize it.

Things are somewhat worse with supplying machine tools to the production bases of electrical installation organizations, which could significantly increase their production of intermediate installation products, were they to be appropriately equipped.

When work space is provided on schedule, and when the client is able to deliver equipment and materials on time, the electrical equipment of compressor stations can usually be installed by brigades consisting of 10-15 electricians and automatic system installers, this number being increased somewhat in the period just prior to start-up. However, if the general contractor is unable to provide the work space on schedule and if equipment and materials are not delivered, a brigade of up to 50 persons must subsequently be concentrated at the facility. This in turn reduces the labor productivity of each worker, worsens management of the work and its quality and leads to overspending of the wage fund and higher production cost.

In order that the work could proceed rhythmically, the periods of idleness could be eliminated and that highly skilled installers could be kept working, general contractors must adhere strictly to the schedule for providing work space. In turn, the electric power supply facilities to support installation jobs must be prepared: conductors, substations, distribution devices, cabling, control rooms, sites and foundations for lighting towers and lightning arresters. Installation of electrical equipment and automatic systems should be started only after construction of the facility has proceeded a significant extent and after the client delivers not less than 80 percent of its equipment and materials.

The experience of installing compressor stations has demonstrated the high effectiveness of joint work by installers and fitters of the organizations of Glavneftegazelektrospectsstroy. They work in parallel, and all of the adjustments are completed almost simultaneously with completion of the installation jobs.

Storage batteries that provide electric power to important control and automation circuits must be installed by highly qualified and responsible workers. This work is done in the main administration by specialized sections of the equipment set-up administration. Sometimes it happens that general contractors call in storage battery installers to compressor station construction sites before the storage battery room is structurally complete, in the absence of heating and ventilation, and before the batteries and special equipment are delivered. As a result it takes 300-400 man-hours to install storage batteries

when the work area is unprepared, as compared to a standard of about 100-150 man-hours.

Use of the modular construction method and other progressive concepts has significantly increased the rate of construction of compressor stations. At the same time certain manufacturing organizations reduce the advantages of the modular method to a minimum by delivering module boxes to the construction site without the electrical equipment and wiring installed. Plant assembly of control rooms has not been organized either. Installation of equipment into module boxes at the compressor station construction site means a significant expenditure of nonproductive labor and time, since the work is made difficult by the crowded conditions. Orders are not placed for the materials required for their installation, and blueprints are absent.

Introduction of the brigade contract is an item of considerable attention in relation to the special jobs that must be performed by the main administration's organizations at compressor stations. However, the work space furnished to the installer brigade at the construction site depends both on the work of a number of related organizations, which the subcontractor can influence only indirectly, and on the construction procedures themselves. This is why the brigade contract may be effective only if buildings, foundations, scaffolding, conduits and other structures of the compressor station are completed and ready for installation, and if the basic production and sanitary engineering equipment is installed and the overhead traveling cranes and single-rail overhead traveling cranes are operating; if slide valve service platforms are installed; if the client delivers equipment, cable products and materials strictly according to the schedule. The pattern of erection of compressor stations can be summarized as a gradual expansion of the work front of all organizations particpating in construction. The sizes of the brigades involved in special installation jobs gradually increase as well--that is, their composition may not be stable, which is not in keeping with one of the basic prerequisites of the brigade contract method.

Most organizations of the main administration doing installation jobs at compressor stations use a piecework-bonus wage system based on estimates drawn up by the administration's production sections. Bonuses are paid to workers for prompt and early fulfillment of quotas out of advances of the bonus for commissioning the facility.

The quality with which cable bedding is poured, the quality with which electrical engineering buildings are installed and so on have important significance to raising the quality of special installation jobs.

The planning documents governing electrical installation and installation of automatic systems must correspond to the present planning level. But the plans do not contain a schedule of the existing blueprints. Changes in documents are not reported to the contractor. Summaries of specifications on equipment and materials required at a facility are not drawn up. Specifications on materials delivered by the client and the contractor are not distinguished, and lists of articles that are produced by shops making the intermediate installation products are not drawn up. Hardly a single plan provides the specifications

on making openings, passages and recesses or on installing walling parts. The routes of electric wiring are often directly over the routes of utility and sewer lines, meaning that previous work must be redone.

Institutes of the Ministry of Gas Industry planning the electrical engineering design and the locations of monitoring and measuring instruments and automatic systems should make broader use of the planning experience of the leading planning organizations of the Ministry of Installation and Special Construction Work. Unification of planning concepts related to compressor stations of the same type would significantly ease the work of the installers when it comes time to prepare the work plans, supply the installation articles and materials and perform the installation jobs themselves.

Obviously it would be suitable to increase the distance between cable supports (to 6 meters). This would mean a savings of a significant quantity of metal, and an increase in labor productivity.

In my opinion we need to introduce slit light guides to illuminate areas of compressor stations offering an explosion hazard, as is the practice at pumping stations on petroleum mains. Use of low-voltage buses at compressor stations equipped with electric drive systems is a highly successful practice. They increase the reliability, life and resistance of cabling to dynamic loads.

Conduits about 200 mm wide must be provided for in machine foundations to lay cabling leading to the electric drive systems of compressor units. Between the conduit and the foundation the cabling will be laid through a straight tube, and from there it will travel flexed in the conduit to the input box.

To make equipment supply easier and to exclude the need for part substitution, the quantity of brands and cross sections of cabling must be decreased to a minimum. The plans for cable routes should foresee overpasses for construction equipment, since breaks occur in cables during construction namely due to this reason.

The training of highly skilled specialists for the Glavneftegazelektrospetsstroy must be improved. One of the vocational-technical schools must be specialized for the training of workers in the most needed occupations for organizations of the main administration--particularly cable men, secondary switch installers and so on.

The supply of special tools and small mechanized tools to installation organizations must be significantly improved as well. Such tools can increase labor productivity in all forms of special installation jobs at compressor stations and at other facilities. Such tools are now being manufactured by plants of the Ministry of Installation and Special Construction Work and the Ministry of Power Machine Building, but they are not being provided to the main administration.

Implementation of these proposals will make it possible to significantly raise the effectiveness of special installation jobs at compressor stations, and consequently to reduce the total time of compressor station construction.

In the next few years the main administration's installation organizations are to do a considerable volume of work at compressor stations. Thirty-two compressor stations must be installed in 1983 just on the Urengoy-Novopskov and Urengoy-Pomary-Uzhgorod gas pipelines.

The laborers, engineers and technicians of the main administration's organizations will do everything necessary to make a worthy contribution to fulfilling the country's fuel and power program.

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